



Photo. J. B. Tyrrell.

A GARDEN AT CROSS LAKE.

THE HUDSON BAY ROUTE

A COMPILATION OF FACTS WITH CONCLUSIONS

BY

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INTRODUCTORY

GROWTH OF GRAIN-GROWING AREAS.

In 1898 Manitoba and what is now Alberta and Saskatchewan had upwards of two and a half million acres under cultivation. The total grain crop was about fifty six million bushels. The wheat crop alone was some thirty million bushels.

In 1906 the area under grain was some seven million acres, and the total yield was over two hundred million bushels, of which the wheat crop alone was some one hundred million bushels.

The total cultivable area in Manitoba, Saskatchewan and Alberta is estimated at one hundred and seventy-five million acres. It would not be safe to count upon the uncultivated portion being acre for acre as fertile as that which has already come under the plough; but it is safe to reckon its productiveness in the ratio of one to two. On that basis of productiveness we can count on at least ten-folding the present grain yield of these provinces when all the now virgin soil is brought under the plough. Instead of one hundred million bushels of wheat there will be produced a billion bushels, and the total grain crop will increase to two billion bushels.

Forty thousand homesteads were taken up last year, and a large area of land was secured by purchase from railway companies for farming. At the present rate of settlement the grain crop will quickly be doubled, and the day of the billion bushels will be within the range of vision.

CULMINATION OF CONTINUOUS GRAIN BLOCKADE.

But as the grain-growing areas have developed the transportation difficulty has increased. There has been a continuous grain blockade in the west, which reached its culmination in 1906, when neither the outgoing grain nor the incoming freight could be handled by the railways. The crop of last year cannot be marketed before this year's grain crop is harvested.

Every hundred miles of railway built in the three great grain-growing provinces increases production by causing grain to be grown where none was grown before. The construction of the Canadian Northern added to the output and created a traffic that now overtaxes its carrying capacity. A similar result will follow the construction of the Grand Trunk Pacific. As our grain crop grows so must other industries. Last year some one hundred and thirty thousand head of cattle reached the Winnipeg stock-yards, and eighty-six thousand were carried to the seaboard. Two million tons of freight were received at Fort William, and out of that harbour there was shipped over two million tons.

LARGER OUTLET ESSENTIAL TO DEVELOPMENT.

It is obvious that there must be a larger outlet to the ocean or the development of the west will be retarded. Grain will not continue to be grown in excess of what can be marketed, and as every section of land added to the cultivated area of the west increases the business, and therefore the wealth of the east, the arrest of western development will be as keenly felt from the Atlantic to the Great Lakes as in the country beyond.

The double-tracking of the Canadian Pacific and the operation of the Grand Trunk Pacific will, say, double the rail-carrying power; and the 'spout' at Fort William and Port Arthur will doubtless be proportionately enlarged. But when that is done, if the development of the grain-growing area increases in the ratio of the last few years, the transportation problem will be then even a larger difficulty in the way of further development than it is to-day. A subsidiary outlet by the shortest possible rail haul to tide water is and will ever be needed. Where is it to be found?

BENEFIT OF THE HUDSON BAY ROUTE.

Canada's great inland sea, called Hudson Bay, gives the west tide water in the meridian of the Mississippi Valley. A glance at the map shows that the shortest route from the centre of Canada's grain fields to the world's markets is via the Hudson Bay and Strait. Churchill harbour is as near the central point of the wheat area as the centre of that area is to the head of lake navigation; and it is about the same distance from Liverpool as is Montreal.

The Canadian Northern Railway will soon reach the Pas on the Saskatchewan river, and from there to Churchill is some 480 miles. With that distance spanned, Winnipeg, which is, via the Canadian Pacific Railway, 1,422 miles from Montreal, would be within 945 miles of Churchill. Brandon is 1,555 miles from Montreal, from Churchill 940. Regina is 1,780 miles from Montreal, from Churchill 1,200. Medicine Hat is 2,082 miles from Montreal, from Churchill, 1,500. Calgary is 2,262 miles from Montreal, from Churchill 1,682. Prince Albert is, by the shortest rail routes, 1,958 miles from Montreal, from Churchill some 717. Edmonton is, by the shortest rail routes, 2,247 miles from Montreal, from Churchill 1,129. And these distances by rail to Churchill are measured over existing railways that were built for carriage east and west. With a railway from the Pas to Churchill, roads would be built over the shortest routes between important centres and that port. With a direct connection between Regina and the Pas the distance to Churchill from that centre would be 774 miles, from Medicine Hat it would be 1,076, from Calgary 1,256 miles.

Churchill is 2,946 miles from Liverpool, while Montreal is, via Belle Isle, 2,761 and via Cape Race 2,927, and New York by the northern route, is 3,079.

There can be no question that, if the route via the bay and strait be feasible, it should be availed of; for its utilization would effect an average shortening of a thousand miles in the distance between the wheat fields of the west and the Atlantic seaboard, without increasing the ocean distance to the world's market.

NAVIGABILITY OF THE BAY AND STRAIT.

THE EARLIER EVIDENCE.

From 1670, when King Charles granted to the Company of Gentlemen Adventurers the country watered by the rivers flowing into Hudson Bay, until Canada by purchase obtained, in 1870, a surrender of the exclusive rights of the company on this continent, the bay was, with the exception of the years when France disputed its possession prior to the treaty of Utrecht, a closed sea to all but the ships of the company, and those whom it permitted to enter upon its waters.

In the course of a century and three-quarters, seven hundred and fifty vessels, ranging from seventy-gun ships to ten-ton pinnaces, crossed the ocean, passed through the straits, and sailed the bay in the service of the company. And only two were lost. A marvellous record, when it is remembered that all the craft were sailers and most of them small and of rude construction, and that the bay and strait afforded none of the modern accessories to navigation in the way of coast aids.

At one time the Hudson Bay Company was well satisfied if its ships wintered safely in the bay and returned the next year. Indeed, a gratuity of fifty guineas was

allowed the captains who made the return trip in two seasons. But by the middle of the eighteenth century the gratuity was only given to the captain who made the return trip in the one season; and what was once represented as absolutely impracticable, was very easily and safely performed.

The navigation was found good enough to admit of the French several times, by water, contesting the possession of the British. In 1782 La Perouse, the French admiral, brought a seventy-four gun line of battleship and two frigates of thirty-six guns each to the mouth of the Nelson River.

The company, from 1860, allowed American whalers access to the bay; and the experience of their captains tends in favour of the view that these waters can be utilized for commercial navigation.

Captain Coates, who was in the service of the company from 1727 to 1751, was very minute in the quaint advice he noted in his journal for the guidance of other navigators, and he was scrupulously careful to be conservative in his opinions. He once got into the straits for some sixty leagues by the 26th of June; but 'such banks and walls of ice' were met that 'little or nothing' was done until the 20th July. 'And there you see,' wrote the captain, 'tis to little purpose to be there sooner, and your hazard is much greater, being the ice is much more compact, much larger and not so mashed and shattered; and 'tis incredible what an alteration the spring tides in the beginning of July make amongst the ice in the mouth of the straits, and what immense bodies it will shatter and break in pieces, which before was dreadful to look at when agitated and put in motion by those furious tides, which are so distracted and cut by those heavy rands of ice which makes them boil up in eddies and whirlpools in the most amazing manner.' He goes on with his description of the ice, and then gives this opinion: 'As it is very hazardous to enter the straits before the beginning of July for ice, so it is dangerous to be in that bay after the middle of September.'

An expedition consisting of *Dobbs Galley*, 180 tons, and the *California*, 140 tons, was fitted out in 1746. The ships were under command respectively of William Moore and Francis Smith. Henry Ellis fitted out the expedition, and a lengthy code of instructions was given for the guidance of the two commanders. This is a summary of the narrative of the voyage:

They left England on the 12th of June, 1746, in company with the Hudson Bay Company's ships. On the 5th of July they began to meet mountains of ice off the mouth of the strait. They reached Resolution Island on the 8th July, and were nearly wrecked during a fog. They met with very little ice to Upper Savage Islands, but on the 13th of July fell in with an abundance of low ice, five to ten fathoms thick. They were abreast of Cape Charles on the 17th of July, much incommodated with ice; on the 30th of July were abreast of Salisbury Island; passed Cape Digges on the 2nd of August, and Mansfield Island on the 4th of August, and on the 11th of August made the Welcome. They went into winter quarters at the end of August in Hayes River, which by the 31st of October was frozen over hard. They got out of winter quarters, and sailed north the 1st of July. They passed Mansfield Island on the 28th of August, bound home; entered Hudson Strait on the 29th of August; had a good deal of difficulty there on account of fog and ice; got out of the strait on the 9th of September, and reached England the 28th of September, 1747.

Captain Falconer, who was master of a sloop in the service of the company, in his journal for 1768-69 noted his conviction that the period of navigation of the bay and strait extended from the latter part of July to the middle of October.

TESTIMONY OF LATER NAVIGATORS.

MR. DICKSON'S VIEW.

Walter Dickson, who was twenty years in the service of the company about the bay and strait, expressed the belief that they could be navigated for five months in each year, and made this statement:—

'From what I have observed of the movement of ice in Hudson Bay during the summers I passed there, I am perfectly assured that an ordinary screw steamer would never have any difficulty in getting through or round that which is usually met with in the bay or strait. The chief reason why the old sailing vessels of the Hudson Bay Company often met with detention in the ice was and is that the season when floe ice is met with there is generally very little wind and sailing vessels are consequently as helpless amongst the ice as they would be in a dead calm in the centre of the Atlantic or elsewhere. The bay has always been found of easy access to a good and careful navigator. From what is known, and the experience already obtained on the subject, there is every reason to believe that, were the Hudson Bay thoroughly surveyed, it would be found to be one of the safest of known seas. I have known a season when the harbours were accessible for seven months in the year.'

Captain James Hackland was thirty-nine years in the service of the Hudson Bay Company. He first navigated the bay in 1846, and for years commanded a schooner that coasted from York to Churchill. He left Orkney on the 22nd June, and passed through the strait in the middle of July. He saw no ice except at a distance to the southward. He wrote: 'The strait is open all the year round. The ice from Fox Channel comes down in July. It never goes into the bay, but follows the current through the strait. The navigation of the western end of the strait is, therefore, most interrupted at that time.'

Captain Colin Sinclair, who was brought up at York Factory and who navigated these northern waters for six years, passed through the strait on a sealing voyage as early as April and saw no ice. He was confident that there was 'no unusual danger or difficulty in the navigation of the bay and strait.'

Captain Silsby, a practical man, engaged for many summers in Hudson Strait and Bay, wrote in 1884: 'My experience tells me that navigation by steam is entirely practicable for four months in the year, viz., July, August, September and October, and in many years the most of November.' He saw no reason why steamships could not make excellent speed on that course to and from Europe for four months certainly in the year, and in open winters for five months.

Captain Kennedy, who commanded the *Prince Albert*, chartered to search for the Franklin expedition, was previously in the service of the company for some eight years at Ungava Bay. In the autumn of 1888 he traversed the coast from Chimo River (Kanebascon River) to George River and coasted that shore line in a York boat every year of the eight years. He found 'no ice after July in the bay and only on one occasion found ice on the 1st November, and then only small pieces of field ice.' He regarded as very regular the currents, which, he wrote, 'open up the channels of ingress and egress into Hudson Bay and convert the bay and strait into a pathway for commerce.'

Captain Hawes, who made fourteen voyages to the bay, and whose opinion Lt. Gordon obtained, placed 'the probable period of navigation for steam vessels, properly fitted for ice work, as seldom exceeding three months, 15th July to 15th October.'

Captain Adams, who had thirty-five years' experience in northern waters, gave this opinion: 'Ships may enter the strait and bay from the 20th to 25th June almost yearly, and the strait remains open till the young ice forms about October 26th. In round numbers the straits are open four months a year, but even when open, navigation at the entrance is sometimes difficult, because the current from Davis Strait carries ice across the mouths of Frobisher, Cumberland and Hudson Straits.'

Captain Thomas McKenzie, of New Bedford, from the experience he gained as a commander on whaling voyages and from the information he gathered from the logs of other ships than his own, concluded that 'owing to the risks of navigation from thick weather and snowstorms,' he 'would not advise risking coming out of the bay after the 10th to the 15th of October.' He added that 'the weather is not as bad inside as it is coming through the strait.'

Captain E. B. Fisher, of East Falmouth, in 1897 stated that he had visited the bay and strait pretty regularly from 1864 in command of whalers. One year he entered the bay on the 19th July, and 'had no great difficulty with ice that year.' But in all his experience of the strait, he 'never found the ice alike in any two seasons. Once he entered the strait on the 1st of August, and got into the bay on the 9th, and 'saw no ice at all.' He 'always made it a practice to leave the Welcome to come home from the 5th to the 10th of September,' and he 'usually got out without any trouble.' In his judgment the strait can be navigated 'from three to three and a half months... by steamers for commercial purposes.'

DR. BELL'S OBSERVATIONS.

The several reports of Dr. Robert Bell, F.R.S., who spent much time in and about Hudson Bay making scientific observations, may, in so far as they refer to navigation, be thus summed up:

Both the bay and strait are remarkably free from rocks and shoals. The groups of islands near the east side of the bay are surrounded by deep water, and a wide channel leads up the centre of James Bay. The main body of the great bay is entirely without shoals, reefs or islands. The depth is very uniform over most of the bay, and nowhere does it present any great irregularities. It averages about seventy fathoms throughout, deepening to one hundred and upwards in approaching the outlet of Hudson Strait; while in the strait itself the soundings along the centre vary from about one hundred to upwards of three hundred fathoms. The bottom appears to consist almost everywhere of boulder, clay and mud. Near the shores a stiff clay, affording good holding ground for anchors, is almost invariably met with.

Along the west coast of the bay the rise and fall at spring tides amounts to about eleven or twelve feet, on an average, and is pretty uniform, diminishing somewhat towards the south. It is greatest at the mouth of the Nelson River, where it reaches about fifteen feet. The tides are lower all along the east side of the bay. In the strait there is a very good tide.

The bay is open all the year round; and there does not seem to be much evidence that the strait is entirely closed at any season. The great width and depth of the strait, and the strength of its tides probably keep it open all winter. From all that he could learn or observe, there appeared reason to believe that the strait and bay might be navigated and the land approached by steamships during an average of over four months each year, or from the middle of June till near the end of October.

REPORTS OF COMMANDER GORDON.

Commander Gordon, who commanded the expeditions of 1884 and 1885, which were undertaken by the government with a view to ascertaining the actual conditions pertaining to the bay and strait, made two detailed reports, from which the following are excerpts:

'The ice has been supposed, hitherto, to be the most formidable barrier to the navigation of the straits, but its terror disappears, to a great extent, under investigation. The ice met with on the cruise of the *Neptune* may be divided into three classes having distinctly separate origins. They are: icebergs from the glaciers of Fox Channel; heavy Arctic field ice from the channel itself, and what may be called ordinary field ice, being that which had been formed on the shores of the bay and straits.

'We met no icebergs in Hudson's Bay, nor did I hear of any being seen there. In the straits a good many were seen, principally along the north shore, where many of them were stranded in the coves, and some were met with in mid-channel. Of those seen in the eastern end of the straits, some had undoubtedly come in from Davis' Straits, passing between Resolution Island and East Bluff; but all of those

met to the westward, had come from Fox Channel, as observations made by Mr. Ashe, at North Bluff, show that an iceberg coming in sight from the westward will pass out of view to the eastward in from three to four tides, showing an easterly set of upwards of ten miles a day. The icebergs seen in Hudson's Straits in August and September would form no greater barriers to navigation than do those met with off the Straits of Belle Isle, nor were they more numerous in Hudson's Straits than they frequently are off Belle Isle.....

The *Neptune* was, on 1st August, at Nachvak Bay, within 100 miles of the east end of the straits and, on 30th August, had just left Nottingham Island on the west end, so that the month of August was spent in the straits region.

The following table is compiled from the meteorological records:—

	Belle Isle Straits.	Hudson's Straits.
Number of days on which fog is recorded.....	13	9
Approximate number of hours of fog.....	220	102
Days on which snow fell.....	0	4
Days on which wind exceeded 25 miles per hour, but did not reach 40.....	6	5
Days on which wind exceeded 40 miles.....	2	1

The month of August thus shows favourably for Hudson's Straits, the fog there being reported on six days only, as against thirteen days in Belle Isle; and the total number of hours of fog being respectively 102 in Hudson's Straits, and Belle Isle 220; and if the duration of the snow storms in Hudson's Straits, nineteen hours be added to the number of hours of fog, it still shows favourably. The number of gales also is six at Belle Isle for five in the straits; and of heavy gales, two at Belle Isle, and only one in the straits.

The following comparison for September is between station No. 1, at Cape Chudleigh and Belle Isle:—

	Belle Isle Straits.	Hudson's Straits.
Number of days on which fog is recorded.....	7	4
Approximate number of hours of fog.....	82	34
Days on which snow fell.....	3	8
Days on which rain fell.....	15	6
Days on which velocity of wind was between 25 and 40 miles per hour.....	4	5
Days on which velocity of wind was 40 miles or over per hour.....	11	3

Days on which any snow fell are put down as snow days, though rain as well as snow may have fallen on those days.

In the character of the weather, therefore, for the two months (August and September) so far as it affects navigation, Hudson's Straits compares favourably with the Straits of Belle Isle, there being eleven heavy gales at Belle Isle against three in Hudson's Straits, and more than double the amount of fog.

The mean temperature of the month at Cape Chudleigh for August was 39°, for Belle Isle 49·67°; and for September—Cape Chudleigh, 32·76°, Belle Isle, 43·1°.

The following table gives the weather experienced in Hudson's Bay, from the 1st to 16th September:—

Cape Digges and Marble Island.

	Mean Temperature.
September 1.—Fair weather, light N.E. winds.....	43°
" 2.—Fine and cloudy p.m., with strong N.E. wind.....	42°
" 3.—Rainy weather, moderate gale from S.E.....	40°

Off Churchill.

September	4.—Rainy weather, strong gale from N.W.	40°
"	5.—Cloudy weather, strong gale from N.W.	40°
"	6.—Cloudy, light rain, light N.W. wind, thick weather. .	39.5°

At Churchill.

September	7.—Fine weather, light S.W. wind.	42°
"	8.—Fine weather, light N.W. and S.W. wind.	44°
"	9.—Fair cloudy weather, moderate N.E. wind.	41°

York.

September	10.—Cloudy weather, light rain, moderate S.E. wind. .	40°
"	11.—Fair weather, moderate N.E. wind.	41°
"	12.—Fair weather, light S. wind.	46°

York to Digges.

September	13.—Fair weather, light N.E. wind.	42°
"	14.—Fog in a.m.; fine p.m., light N.E. wind.	35°
"	Foggy weather, strong N.W. wind.	34°
"	16.—Fair weather, light N.E. wind.	32°

'The above shows one gale lasting nearly three days, viz., the 3rd, 4th and 5th, and two days on which fog occurred. On the 14th the fog lasted from 9 a.m. to nearly 3 p.m., closing down again early on the morning of the 15th and continuing thick fog until about 3 p.m.

'The temperature of the surface water off Belle Isle on 25th July was 41.6°, which gradually decreased as we proceeded northward to 34.7° on 4th August, off the entrance to Hudson's Straits.

'On the homeward voyage these temperatures were: off Hudson's Straits 32.5° on 29th September, and abreast of Belle Isle, but some distance to the eastward, 36° on 9th October.

'In Hudson's Straits the mean surface temperature as obtained from observations taken when the ship was at sea, was, on the west-bound voyage, found, to be 32.9°, the highest mean of a day's observations was 33.3°, and the lowest 32.6°. On the homeward voyage the lowest daily mean was 31.8° and the highest 33°. The highest temperatures were in each case observed at the eastern end of the straits and the lowest off Nottingham Island.

'In the bay the surface temperatures varied much with the geographical positions, being 39.4° off Marble Island, 41° off Cape Churchill, 39.7° about 100 miles north-east of York Factory, observed whilst steaming across to Cape Digges, and 36° off the south end of Mansfield Island.

Hudson's Bay may, therefore, be regarded as a vast basin of comparatively warm water, the effect of which must be to considerably ameliorate the winter climate to the south and east of it.

'The resident factor at Churchill informs me that the bay never freezes over so far out from shore, but that clear water can be seen; and as the temperature of the water must be above 28.9° Fah. (the freezing point of salt water) when at the same time the temperature on shore is below zero, we have a set of conditions which will cause a regular area of low barometric pressure to remain over the bay during the winter, with prevailing west and north-west winds and very cold weather on the west and north-west of the bay, as shown by observations at York Factory; whilst on the opposite side of the bay winds from south-west, south and south-east would prevail.'

In concluding the meteorological portion of his report the commander pointed out that 'so far as meteorological conditions are concerned, the bay has been proved

navigable early in June,' and that 'the barque *George and Mary* sawed out on the 7th June of this year, and was cruising under sail from that date onwards in the northern part of the bay.'

COMMANDER GORDON'S JUDGMENT.

Commander Gordon showed great care in securing data on which to base an opinion, and marked caution is evinced in his reports on both his expeditions not to create any foundationless impression as to the length of the period of safe navigation in the bay and strait. This is the opinion expressed in his report on his second cruise:

'If we regard the presence of field ice as the only barrier, the information which we have got would point to the months of July, August, September and October as being the months in which the straits are passable. As a rule, in July there will be delays, but to vessels strengthened and sheathed there would be no danger making the passage. All the inhabitants of the Labrador, the Straits and the Bay, spoken to on the subject, agreed in stating that the ice movements this year were much later than the average; at Fort Churchill the season was fully a month late, and on the Labrador three weeks, so that I think that it will be found that on the average four months will be the length of the season for practical navigation by steam vessels which would be freight carriers. There have been, I am informed, seasons when the straits were clear of ice in the month of June, but they are, according to the logs of the Hudson Bay ships, quite exceptional. Capt. Hawes spoke of such being the case only once in his experience of fourteen years, and the dates which I have seen of the arrival of the Hudson Bay vessels at their ports of destination show no arrival earlier than August.'

THE EXPERIENCE OF THE 'DIANA.'

In 1897 an expedition was despatched under Commander Wakeham to the bay for the purpose of making 'a further test over a longer season, both spring and fall,' than those from which Commander Gordon has made his deductions. Commander Wakeman had under him, in the steamship *Diana*, Capt. James Joy, of St. John, as first officer, and Captain Whitley, as navigating officer. Both men had large experience in northern waters. Commander Wakeham made, in December, 1897, a very full report of his voyage.

On the 3rd of June the *Diana* sailed from Halifax. On the 20th June what was thought to be Cape Mugford, on the Labrador coast, was sighted. The ship stood in for Table Head, but twenty-five miles from land met closely packed field-ice, which seemed to extend to the shore. To the northward the ice extended much further out. The vessel was then put about and stood out to the eastward, and inside of her position and north of Cape Mugford, icebergs, 'some of enormous size, were seen.'

On the 22nd June the *Diana* headed in for the mouth of the Strait. The ice was running abroad as the ship got into it, but she turned and twisted her way round the floes at full speed. The bulk of the ice passed through did not seem to be more than one season old, and from five to six feet in thickness. Scattered through it there were a few bergs, numerous growlers, and a good deal of heavier or old floe ice. Two jams of ice were observed, of not more than ten inches or a foot in thickness, which could only have been made in April or May, probably in open pools in the heavier ice. At 6 p.m. on the 22nd June the 'Buttons' or Cape Chudleigh was made 'through the fog.' There was, too, a heavy bank of fog away to the north, but from the nest top Resolution Island could be made out. When well abeam of the 'Buttons' there was sighted 'a considerable field of ice about five miles to the north, which seemed to fill up the channel extending to the north shore. The ice in the pack was heavier than any passed through that day and allowed no open water. A course was shaped along the southern edge of the pack for the centre of the strait. This pack was passed, more ice was gone through and for hours of the following day, the 23rd June,

the ship steamed at the rate of nearly nine knots an hour 'over a summer sea.' But at 3.15 p.m. she came up against 'a wall of closely packed, heavy ice, much rafted,' which 'extended from the north shore in a southwesterly direction across the Strait' as far as could be seen. This was about abreast of Saddle Back Island. Observations made on the 24th led to the conclusion that the 'ice barrier extended right across from north to south and that on the north shore it extended into the mouth of Ungava Bay, and thence across in the direction of Cape Cudleigh.' An effort was made to push through the pack on the 25th. But little headway was made, and the ice showed 'no disposition to open in lanes or run abroad as it would if it were not bound from shore to shore.' On the 26th the ice behind 'shoved and packed up,' and a 'number of blasts to protect the rudder' had to be set off. 'The ice blasted was from ten to fifteen feet thick.'

On the 28th June, it is noted that 'it froze hard last night.' The 29th was 'warm and mild,' and the ice showed some signs of giving abroad. At 3.15 p.m. the ship 'forced ahead' in 'a light swell' by pushing through the softened and broken up ice and by working round or ramming at the 'large pans of solid ice'; but later 'a barrier of heavier ice' was encountered which could not be penetrated. The jam was 'much rafted'; the ice floated 'from one to five feet above the water'; and 'measured from the bottom of the pan to the surface of the water,' ran from five to nineteen feet.

'From the solid condition of this ice,' Commander Wakeham concluded that 'much of it was more than one season old,' and he recorded this opinion: 'Through this ice in its present state no vessel could possibly penetrate.'

The ship forced its way in a bit on the 30th; but by night 'the ice began to raft' and she 'got pretty severely nipped.' One large pan was forced under the port quarter and the vessel was lifted by the stern about four feet. 'She strained and groaned a good deal.' The 'ice was so heavy' nothing could be done, and there was 'a good deal of anxiety.' 'The pressure continued until 1.30 a.m.' of July 1st, but the betterment was of short duration, for the ice 'rafted up considerably during the night.' By 10 a.m. 'the shoving began again' and boats were prepared and men told off in case the crew had 'to leave the ship in a hurry.' The 'ship hove over to starboard by a passing pan under her port quarter,' and was lifted bodily about five feet out of the water. On the 2nd a pan took her 'fairly in the stern,' 'the rudder was twisted to one side and broken off a little below the water line, the ship was driven into a heavy pan' and 'the ice rafted up on both sides.' The pan of ice which did the damage was about three-quarters of a mile in circumference, and by actual measurement, at several points, from seven to twelve feet in thickness.

On the 3rd the rudder was mended, and the *Diana* worked 'about a mile ahead into what seemed a softer spot.' Prince of Wales Sound could be seen from the nest, and the beacon on the bluff of Hope Inlet could be made out. She steamed a little further and 'made fast to a small pan'; but 'extensive and heavy pans' were all about. On the 4th the *Diana* had 'a severe nip. the ice banked up on the port side level with the rail, while on the starboard side it broke off and passed under the ship, finally lifting her about five feet out of the water'; and thus relieved the pressure, which had been so great as to make the between deck and main deck heave up and begin to leak and the rigging to hang quite slack. 'All stood ready to leave the ship.' On the 6th the 'ship was coming to herself again' and repairs were done. By the 8th she was driven close towards the shore near the easternmost coast of Savage Islands. It is noted that the *Diana* received blows that 'no ordinary freight carrier could have stood for a moment.' There was 'a thick fog with a fresh north-wester'; the ice was 'closely run together,' and the whole was 'drifting *en bloc* out of the strait.'

On the evening of the 10th the *Diana* got clear of the ice and steamed ahead in open water; but by noon of the 11th 'thick fog and heavy ice' forced her to make 'fast to a pan.' Later on she pushed ahead and 'the western end of Charles Island

was abeam' that night. Fog prevented the passage of the channel between Cape Digges and Mansfield Island into the open water of the bay. Digges Island was sighted on the 13th.

On the 20th July at 1.30 p.m. the *Diana* left Hope Inlet on the return, and on the morning of the 21st made the 'Button Islands.' There was 'ice in Ungava Bay and a narrow belt of ice extended along Cape Chudleigh and for about ten miles to the eastward of Button Islands.' The wind was 'driving the ice out of Ungava Bay round the Cape Chudleigh shore.' Commander Wakeham noted that, since getting clear of the ice on the 15th, none had been seen which would 'impede any ship.' By noon of the 21st the ship was put about and 'stood back up the strait'; but on the 22nd she layed up on account of 'heavy packed ice.' On the 24th she rounded Digges Island to the south and anchored in Port Laperrière. A good deal of ice had been met with, and the Commander noted on the 23rd that 'it would not have been possible for an ordinary freight steamer to have pounded her way through the ice.... met, since yesterday evening as quickly as did the *Diana*.'

On the 25th the ship left Port Laperrière and on the 27th looked for Green Island, was 'stopped by the ice in Ungava Bay, kept along the edge, got within twelve miles of Port Burwell, but was separated from it by a heavy belt of ice.... packed along that shore and setting out of Ungava Bay round the Buttons of Cape Chudleigh.'

On August 1st the ship made Nachwak Bay. Considerable ice had been encountered on the 28th July. The *Diana* was then some twelve miles off Port Burwell, and there was compact ice between her and that point. Standing out round the 'Buttons' considerable field ice was met, but it was scattered and worn round the edges, with lanes of open water here and there. On the 13th August a start was made for Cumberland Bay. Standing in from Cape Mercy on the 15th for Cumberland Channel, fog was met at intervals, and icebergs were seen.

Anchorage was made under Black Lead Island on the 18th, and towards evening on the 19th a start was made for Hudson Strait. A few small bergs were passed on the 20th. At midnight it was 'too thick to run,' but on the morning of the 21st Resolution Island was made. At noon 'the Buttons were abeam'; Port Burwell was made by the afternoon, and in the evening the *Diana* was off for the bay. On the 24th she hauled up to the north of King Charles Cape and 'came up with a wall of ice reaching from the end of Salisbury Island in a north-easterly direction as far as' could be seen. A course was therefore shaped 'to pass round Nottingham Island, and down between Coates and Mansfield Islands.' After rather bad weather, with considerable fog, the *Diana* anchored in Churchill Harbour on the 29th August.

On the 2nd September she left to cruise the bay. She made Cape Digges on the 7th, after encountering rather bad weather; but no ice was seen, only 'a decided glint' of it to the northward. Bad weather continued and Douglas Harbour was made on the 10th. A cruise was made to Ungava Bay and the company's post at Fort Chimo.

The *Diana* arrived at St. John's, Newfoundland, on the 25th September, and left on the 6th October for Chateau Bay. A large berg was passed on the 7th and heavy weather was experienced. On the 8th Pitt's Harbour was made. On the 10th the ship left for the north. There was heavy snow and bad weather, and bergs were seen, but the Button Islands were made out on the 15th, and though the ship was 'a good deal iced up,' she was abeam of the high land of Big Island on the 17th, and in the afternoon of the 18th was anchored in Douglas Harbour. Men were sent for water, but they found 'the stream frozen solid.' Water was got from a lake on the 21st, but 'it froze in the boats, in the buckets and about the men.' The Commander remarked 'winter has undoubtedly set in here.' On the following day a course was shaped 'to pass a fair distance north of Charles Island.' There had been 'more or less snow every day' since entering the strait on the 15th. The thermometer went to 18°. No ice was met. Snow continued. The weather grew colder and on the 24th there was 'dry snow which is like fog.' Port Laperrière could not be made, and

it was decided to steam back to Douglas Harbour, where anchorage was made next morning, and where there was 'clear weather with the sun shining brightly, while out in the strait and the outer bay it is snowing heavily.' The Commander remarked: 'We have noticed each time we got into harbour both here and in O'Brien's, the same condition existed; inside moderate, fine weather—outside a drift, vapour and snow.'

On the 27th a start was made for Hudson Bay. 'It is neither ice nor cold that is bothering us,' wrote Commander Wakeham, 'but constant strong winds from various directions, never long in one quarter, and snow; we have the greatest difficulty in picking our points, and with the strong tides, uncertain currents, no soundings, a knowledge that the hydrography of the coast is entirely out, we believe we are running greater risks than are warrantable.' And so the attempt to reach the bay by the end of that October was abandoned. Halifax was reached on the 11th of November.

THE VERDICT OF COMMANDER WAKEHAM.

Commander Wakeham—in his summing up stated:

'There can be no question we were favoured with an unusually open season, and once the strait became open on the 15th July, we encountered much less ice than others have constantly met with.' He quoted Mr. Stupart, Director of the Meteorological Service, in support of this view. That officer wrote: 'It is very obvious to me that you had this year a most favourable and open season, and that the winter weather set in later than usual. The most doubtful thing is the force of the wind. According to the records you had very few gales indeed.' The Commander continued:—

'I now conclude this part of the report by saying that I absolutely agree with Captain Gordon in fixing the date for the opening of navigation in Hudson Strait, for commercial purposes, by suitable vessels, at from 1st to 10th July. I do not consider that the strait can be successfully navigated in June. Such ships as the *Diana* might force a passage through, but these vessels would be useless for commercial purposes. They have to be so braced and strengthened that they are impossible freight carriers.

'I consider that navigation should close from the 15th to the 20th of October. I would not dread the ice in October, though there is always a chance of the western end of the strait being blocked by the Fox Channel ice between Nottingham and Digges, or even about Charles Island. I believe, however, that as westerly winds prevail at this season the block would not be permanent and a passage will generally be found along the Labrador shore, which is bold and good. In Captain Hawes' journal at Churchill, which is certainly the most available harbour on the western shore of the bay, I found that on the 1st of October, 1895, his men were off hunting on snowshoes, and there had been good snowshoeing for ten days. The ice was also at that date running up and down the harbour. Of course the harbour does not freeze over before the end of October, but for some time before it closes it would not be safe for vessels, owing to the rush of the ice in the strong current. We were favoured with a mild and comparatively calm month, yet the risks of navigation were so great that I have no hesitation whatever in saying that, after the last date which I have given above, it would be folly to think of carrying on any commercial traffic through the strait. I would, therefore, fix the 20th of October as the extreme limit of safe navigation in the fall.

'There is another and serious obstacle to the later navigation of the strait which I have not seen mentioned elsewhere—that is, the blocking of the eastern entrance of the strait by the descent of the Baffin's Bay ice.' 'It is carried right across the mouth of Hudson Strait which is only separated from Frobisher Bay by Resolution Island; and on down the Labrador shore to the north-east coast of Newfoundland. It moves on and off shore with the wind. As described by Hall, it is a heavy pin-

naced ice, into which it would not be safe to put a loaded ship during the end of October.

This pack has, therefore, to be reckoned with by everyone coming out of Hudson Strait during the end of October. It has been down as early as the 15th October; we saw nothing of it on the evening of October the 30th last, but it was snowing heavily at the time, and we might have passed close to the pack without seeing it. It could not have been far away, as the ice was in sight from Belle Isle during the first days of December. Given a drift of 15 miles a day, which is not an excessive allowance, it must have been past the mouth of Hudson Strait on the 1st of November. Therefore, for all the reasons I have enumerated, I consider the 20th of October as the extreme limit of safe navigation in the fall.

AN IMPRESSIVE OPINION.

Lieutenant Schwatka, of the United States Navy, who was with the expedition in search of the relics of Sir John Franklin, thought four months, or even longer, the probable period. He wrote:

'I was in Hudson Bay and Straits and adjoining countries about two years and a quarter, and during that time saw considerable of the navigation of these bodies of water, and discussed the subject very often with navigators who had spent very many years therein, principally American whaling captains, their officers and crew. From my experience and their conversation, I thought the Straits and Bay could be considered navigable for at least two months of the year for sailing craft and this would probably be more than doubled for steam. Of course, the bay is navigable much earlier and later than the straits, and the above estimate is for the latter.

'Again, a ship strengthened for the ice might prolong these times on each end considerably, and a complete hydrographic survey of the straits, giving all possible harbours of refuge, would show that there is less danger than there is generally supposed. Signal stations on prominent points could also materially assist vessels essaying the passage by a simple code expressing the conditions of the ice.'

THE EXPEDITION OF 1904-5.

Mr. A. P. Low, F.R.G.S., now director of the Geological Survey, accompanied the expedition of 1897. The following summer he again passed through the strait in the steamer *Erik*. He commanded the *Neptune*, which was chartered by the Dominion Government for the expedition of 1904-5. He made a careful study of conditions; and in his 'Cruise of the *Neptune*' states very clearly his conclusions and the facts upon which they are based. He thus describes the strait and the cruise to Churchill:

'Hudson Strait has a length of nearly five hundred miles from Cape Chidley, on the south side of its eastern end, to Cape Wolstenholme, on the same side of the western end. The general trend of the strait is a little north of west, so that the western cape is about a degree and a half to the northward of the eastern one, and is in 62° 30' N. latitude. At its eastern entrance the strait has a practical channel nearly thirty-five miles wide between the outermost Button Island off Cape Chidley, and the shores of Resolution Island on the north side. Gray Strait is a narrower channel between the Button Islands and the southern mainland. Immediately to the westward of Cape Chidley the southern shore falls away to the southward to form the great Bay of Ungava, which is one hundred and forty miles wide, and somewhat more than that distance in length. The large island of Akpatok lies in this bay, but as its north end is to the southward of a line drawn across the mouth of the bay, it does not seriously interfere with navigation in the strait.

'From Cape Hopes Advance, the western point of Ungava Bay, the southern shore of the strait has a northwest direction to Cape Weggs, situated one hundred

and fifty miles beyond. The northern shore opposite has the same general trend, and the strait for this distance averages sixty miles across. Big Island, situated on the north side in the western half of this portion, extends southward, so as to reduce the width to thirty miles.

'To the westward of Cape Weggs the general trend of the south coast is nearly due west, while the opposite side continues northwest to form Gordon Bay, after which it bends to the west and south, so that at its western end the strait is about one hundred miles from mainland to mainland, but of this distance the practical channel is limited to that portion between the south coast and the large island of Nottingham, a distance of thirty-five miles.

'In the western half of the strait, Charles Island, which lies about twenty-five miles beyond Cape Weggs, is the only obstruction to navigation. This island is twenty-five miles long, and lies nearly due east and west, some twenty miles from the south shore of the strait. The ship channel passes to the northward of the island, although there is a good channel on its south side.

'The depth of water in the ship track through the strait varies from fifty to two hundred fathoms. There are no shoals, and with ordinary precautions, there is little danger from stranding on the bold shores of either side of the strait, or on the few islands that bound the channel.

'A number of safe harbours easy of approach have been explored on the southern side of the strait, and others equally good and safe are known to be located on the north side, although they are at present unsurveyed.

'The passage from the western entrance of the strait to the port of Churchill, on the western side of Hudson Bay, is five hundred miles. From the mouth of the strait, the course is due west for seventy miles to the eastern end of the wide channel between Coats and Mansfield Islands. This channel is practically one hundred miles long, and varies in width from fifty miles at the eastern end to over a hundred at the other.

'The general course of the ship track from the eastern end of this channel to Churchill is nearly southwest, and there are nowhere any dangerous shoals or other obstructions to navigation.

'In the track across Hudson Bay the depth of water varies from fifty to two hundred fathoms, while the approach to the low shores of Coats and Mansfield and those of the western mainland is signalled by the gradual lessening of the depth of water, which gives ample warning to ships approaching the land.

'It will be seen from the above description that there is no natural difficulty in the navigation of the bay and strait so far as the depth of water, presence of obstructions and width of channel are concerned, and if situated in a more southern region the route would be an ideal one for the navigator.'

MR. LOW ON ICE AND WEATHER CONDITIONS.

He thus deals with the question of the ice impediment to navigation:

'Ice commences to form in the smaller bays of the northern parts of Hudson Strait early in October, and by the end of that month the northern harbours are frozen over. The more southern ones, especially those at the mouths of the larger rivers, do not close until late in November or early in the following month. By the beginning of January, James Bay is frozen across, and at the same time solid ice usually extends from the east coast of Hudson Bay to the outer line of islands, some sixty or seventy miles from that coast. In other parts of Hudson Bay, and in Hudson Strait, a margin of solid ice usually extends from one to five miles from the shore, except where the coast is high and bold with deep water close to the base of the cliffs. In such places, especially at headlands, solid ice does not form, and the natives in winter often have to make long and difficult detours inland to pass them.

'The main body of Hudson Bay does not freeze solid, and the same may be said of Hudson Strait. Although this is the case, these waters are quite unnavigable

for ordinary ships during the winter and spring months owing to the great sheets of heavy ice borne backwards and forwards by the tides and currents and drifted about by the winter gales. There is little doubt that a specially constructed ship for ice navigation might pass through Hudson Strait at any season, but the voyage would be a long one, and the difficulties and dangers would be great.

The ice of Hudson Bay and the greater part of that of Hudson Strait is of local origin, being formed by the freezing of the surface of the sea near by. Observations on the growth in thickness of the ice were made in Fullerton Harbour throughout the winter of 1903-4.... These observations show that the thickness increases steadily until the month of June, when a maximum of seventy-four inches was measured. The conditions under which this was obtained were very favourable for the ice, and only in similarly protected northern harbours does it attain such a thickness. In the larger bays and along the unprotected coasts, where the ice freezes later, and is frequently broken up by gales during the winter, the thickness rarely exceeds three or four feet. This thinner ice makes up the greater part of that found in the spring-time covering the waters of Hudson Bay and Strait.

As the ice continues to increase until June, winter conditions continue well into that month, and it is not until its last days that the heat of the sun is sufficiently strong and sustained to begin the melting process. With the advent of July this process is well under way, and the daily change in the condition and amount of the ice is then marvellous, so much so that where everything was fast frozen in the beginning of the month, by the middle not a vestige of ice remains.

If a single thickness of sheet ice covered these northern waters they would be completely clear early in July, but, unfortunately, much of the floating ice is 'rafted' or piled up, sheet on sheet, and the whole cemented solidly together to form large masses often twenty feet or more in thickness. This rafting is caused by the pressure formed by large masses of ice driven together, or against ice attached to the shores, which causes the ice along the margins to break and buckle, cake on cake. These pressure areas are often of considerable size, and usually are many times longer than broad. They serve as a framework to hold together large fields of single sheet ice. When the thinner ice melts, these pressure masses remain, and are dangerous to shipping until the water has become sufficiently warm to melt the ice cementing the cakes together; then they are harmless, as the slightest shock causes the mass to fall to pieces with a great commotion but with little danger. This disintegration is known as 'calving.'

The northern ice which occasionally enters Hudson Strait in the early part of the winter, as before described, is much more complicated and much heavier in character than the local ice. Some of this ice may be met with in the early period of navigation, to the eastward of Big Island, and should be treated with respect. The icebergs included with it often remain until late in the season, and form a source of danger in foggy weather, but they are usually so few as to be negligible, especially in the western half of the strait.

Hudson Strait and Hudson Bay do not freeze solid, but are so covered with masses of floating ice as to be practically unnavigable for at least seven months in the year. The ice does not begin to melt until well into the month of June, and is not sufficiently melted for safe navigation with ordinary steamers until the middle of July. No ice is formed in the strait and bay sufficiently heavy to obstruct ordinary navigation until the latter part of November, but towards the close of this period there is danger from the early passage of the northern pack across the mouth of the strait, and also to a much less degree, from the ice from Fox channel partly closing the western entrance to the strait.

When the temperature of the air falls several degrees below zero, as it does in November, a thick mist or fog rises from the open water and renders navigation somewhat dangerous. In the early part of the season before the ice has completely melted, fogs are liable to occur in proximity to the ice fields. At other times fogs are not prevalent, and the weather is ordinarily fair.

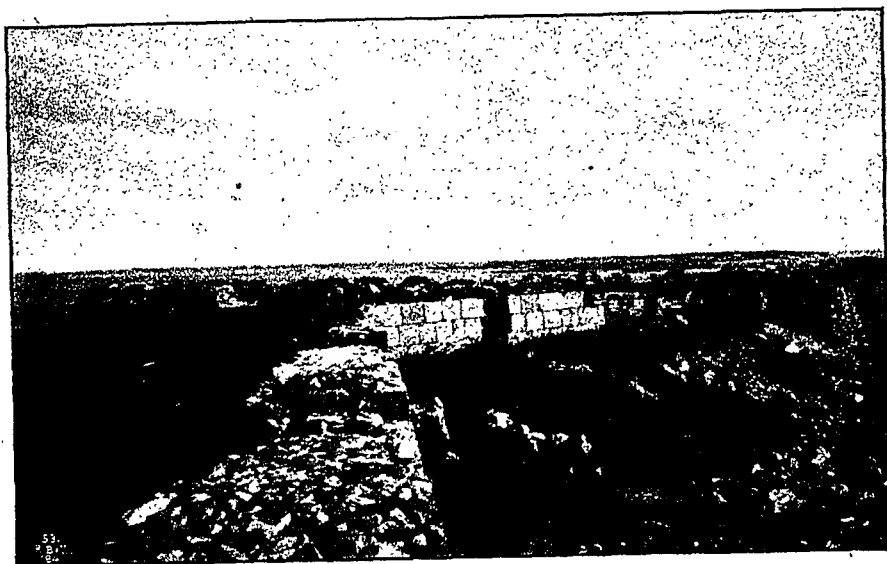


Photo. by Dr. Robert Bell.

RUINS OF FORT PRINCE OF WALES—CHURCHILL—FROM THE WEST.



Photo. by Dr. Robert Bell.

RUINS OF FORT PRINCE OF WALES—CHURCHILL—LOOKING N.E.

'The worst storms come from the south and east, and these are usually accompanied by rain in the summer and by snow later in the season. Northerly winds bring clear cold weather as a rule.'

MR. LOW'S CONCLUSION.

'The period of safe navigation for ordinary iron steamships through Hudson Strait and across Hudson Bay to the port of Churchill, may be taken to extend from the 20th July to the 1st of November. This period may be increased without much risk by a week in the beginning of the season and by perhaps two weeks at the close.'

THE VIEW OF A CHURCHILL RESIDENT.

Mr. Beech, who has lived at Churchill for two years and who recently returned there after a visit to Winnipeg, stated:

'There is a most erroneous feeling prevailing throughout Canada with regard to the difficulty in navigating the straits at the mouth of the bay. It is my opinion, based on facts from many sources, that these straits never freeze over, and that the only danger to navigation is when the ice-floes are running in June and July. I know for a fact that in 1905 the steamer left Fort Churchill on October 24th and made the trip to St. John's, Newfoundland, in eleven days. The straits were wide open until that time, and surely with such a short haul the greater part of the grain could be shipped before November 1st. . . . The bay is open all the year round, and was open when I left there on January 3rd last.'

THE SUMMING UP.

The reports and opinions quoted evidence quite a diversity of view as to the period of safe navigation. Doubtless some are too optimistic, while others are too cautious. But leaving aside the sanguine opinions and considering only the conservative views, the conclusion is clear that Hudson Strait and Bay afford a safe commercial route to Europe for at least three months in the year, from towards the end of July to about the end of October. It would not be a feasible rival route to that via Montreal, but it would be an adequate subsidiary one—a means of relief from grain blockades such as now endanger the continued development of the west.

THE RAILWAY ROUTE.

To reach this waterway it is necessary only to build 480 miles of railway. That is not an extensive undertaking, nor is it in the nature of an absolutely new enterprise. Years ago Canada embarked upon the project of rail communication with the bay. Not only were charters granted, but a special provision was made by parliament for giving a particularly large land grant in aid of the construction of the road. The grant has been made in part, and as a result we have a railway from Winnipeg to Erwood and beyond, and in course of construction an extension to the Pas. The very purpose of the grant was to secure construction to the bay. There is no justification for stopping at the Pas. Having gone so far, and having paid so liberally for the commencement of the work, we should not stop within less than five hundred miles of the point we set out to attain. The policy of reaching the Hudson Bay waters and utilizing them as a route to Europe has been entered upon. The question now is simply as to the completion of that policy.

From the reports that we have of the country between the Pas and Churchill it would appear that there are no unusual difficulties in the way of railway construction; and that the territory is not without resources.

In the summer of 1896 Mr. J. B. Tyrrell explored the country north of the mouth of the Saskatchewan river. As a result of the exploration he states in his report: 'From Nelson river westward to longitude 100° 30', and from the north end of Lake Winnipeg northward to beyond latitude 56°, the country is generally covered with a coating of stratified clay, varying in thickness from a few feet up to fifty, sixty or even one hundred feet. This clay is of much the same character as that of the Red River valley, having been, like it, deposited in the bed of the old post-glacial lake that once occupied the basin of Lake Winnipeg. The rivers have, as a rule, cut down through this clay to the underlying rock, but away from the water-stretches rock exposures are not of very frequent occurrence. The soil is rich and fertile, and the country will doubtless produce in abundance all the hardier roots and cereals grown in the province of Manitoba, and cattle, sheep and horses could be successfully raised. If the country were made accessible by a railway passing through it to Hudson Bay, it would certainly support a considerable agricultural population.'

This report was received with much incredulity at the time it was made public, but its correctness has since been abundantly proved, as is shown in the following pages.

FROM THE PAS TO SPLIT LAKE.

The country extending from the Pas on the lower Saskatchewan to Split Lake, where the Nelson River approaches nearest to the Little Churchill, was explored last season by Mr. William McInnes, of the Geological Survey. In his very instructive report he divides the country into three areas: the limestone of Northern Manitoba, the Archaean—a broken and rugged country stretching from the limestone to the 'gently rolling, clay covered country,' extending 'from the valley of the Nelson River on the east to approximately W. long. 99° 30', where the general elevation of the land is in the vicinity of nine hundred feet above the sea.' The northern boundary of 'the clay basin' was not reached, but the Indians of the Burntwood River region agreed in saying that the Churchill River valley forms its most northerly extension. Mr. McInnes writes:

'The last of the three divisions is, generally, well suited for cultivation, but throughout the first two the areas suitable for agriculture are of limited extent. No part of the region is prairie, though along some of the valleys, and here and there on the uplands are found extensive hay marshes, with only occasional small clumps of willows that, with drainage, would become virtually prairie lands.....

'Though a wooded country throughout, there are but limited areas where the forest growth is of a size to be commercially of much value. There are no hard woods, the only deciduous trees that attain merchantable measurement being the canoe birch, the aspen and balsam poplars and the tamarac. Black spruce is the most abundant coniferous tree and grows to a size sufficient, at least, for pulpwood. Associated with tamarac, it covers all the more marshy tracts, giving way, where the land becomes dryer to white spruce, which is the timber tree of the region, and, on the driest ridges to Banksian pine. Forest fires have been widespread and most destructive throughout the whole region, sparing only the very wet muskeg areas and a few tracts isolated by surrounding water or marsh. In some places on the uplands the charred stumps were seen to indicate the passage of two successive fires at intervals of about forty years. Most of the fires seem to have been due to carelessness on the part of native travellers, for violent storms with lightning are not of frequent occurrence; and during the whole summer but one trunk was noticed that had been shattered by lightning.

'Quartz veins are plentiful throughout the Keewatin belts, but with the exception of arsenical and iron pyrites and traces of copper, no valuable minerals were found in them, though their character, particularly where exposed on the Grassy River below Reed Lake, was considered promising enough for the occurrence of the minerals that are so often associated with these rocks. Palaeozoic limestones cover

all the country between the Saskatchewan and an east and west line cutting the southern ends of Reed and Wekusko Lakes. . . . The rocks are, as far as examined, magnesian, and are probably all dolomites. They occur in flat-lying or gently undulating beds, varying in thickness from six feet or more to quite thin and shaly, the latter occurring near the base and the heavy beds forming the mass of the formation. Many of the heavy beds are even-grained and uniformly bedded, so that they can be readily taken out in blocks of even thickness and of any required size. Many of the low cliffs near the lakes are so situated as to be admirably adapted for quarrying.'

ALONG THE NELSON.

As will be seen on reference to the map, Mr. McInnes's route ran from Lake Winnipeg via the Nelson River to Split Lake and thence along the Burntwood River and File River and Lake to Reed Lake, across Wekusko Lake, to a point between the Grass and Burntwood Rivers, back to Reed Lake and thence along the chain of lakes to the Pas. Of the country along the Nelson he writes:

'Between Lake Winnipeg and Split Lake, a distance of about two hundred and twenty-five miles, the (Nelson) river has a descent of approximately two hundred and seventy feet. The current between the numerous lake expansions is generally swift, and upwards of a dozen falls and rapids occur, some of the former offering magnificent sites for water powers. The aggregate power that could be generated along the river is enormous, as the amount of water passing over the various falls is very great. The volume of the river can best be appreciated by a consideration of the extent of its drainage area, which embraces all the country westwards to the mountains, between the watershed of the Churchill and Athabaska on the north, and the Missouri on the south, and eastwards to the headwaters of the Albany river, and to within fifty miles of Lake Superior.

'Twenty-one miles down the river the Hudson's Bay Company maintain a fur-trading post known as Norway House, situated on a large island in Playgreen Lake. Here Mr. McTavish, the Chief Factor in charge of the district, cultivates a large garden where, on the 10th of June, peas, beans, beets and other vegetables were well started. Wheat has been successfully grown here as well as at Cross Lake further down the river. There are many tracts of land along the river suitable for cultivation. . . . which alternate with glacial gravels and the bare rock surfaces devoid of any soil cover. . . . The exposures at Cross Lake are promising looking for the occurrence of gold, representing closely, as they do, the gold-bearing strata of the district east of Lake of the Woods. They are cut by intruded masses of the same crushed granite with blue opalescent quartz, known locally in the eastern region as *Protophine*. Below Cross Lake no land is under cultivation until Split Lake is reached, just north of latitude 56°, where the postmaster for the Hudson Bay Company raises potatoes and the commoner garden vegetables. White and black spruce, tamarac, aspen, balsam poplar and white birch form the forest surrounding the lake, the deciduous trees for the most part growing only in a fringe along the immediate shores. Trees of suitable size for sawing into eight and ten inch boards are found on the islands, along the stream valleys, and in places near the lake shores, but the general average size of the trees inland is smaller than this. Northwest of the Hudson Bay Company's post the country is generally low, swampy and intersected by a network of small lakes; near Waskaiowaka Lake, however, an extension northeasterly of the clay land of the lower Burntwood Valley forms a comparatively dry ridge along which a good route for a railway can probably be found to the valley of the Little Churchill.'

THE BURNTWOOD RIVER COUNTRY.

The Burntwood river flows from the west into the long westerly bay at the southern end of the lake. Mr. McInnes thus described the country:

'The shores of the bay into which the river flows are, almost all along, low, rounded ledges of fine black and coarser white biotite gneiss striking east and west. The neighbouring land is low, rising from the lake to a height of about twenty feet in a few chains, and then much more gradually to about fifty feet, with occasional ridges of sand and clay reaching elevations of seventy feet. The forest is mixed second growth, mainly spruce and tamarac, varying in age from recent brûlé to fifty years.

'The water of the Burntwood carries in suspension more sediment than the main Nelson, so much as to be hardly at all transparent. As the lake is left and the river ascended the banks become higher, rising with a steep slope from the water level to fifty feet, and are composed of a siliceous clay that, where exposed through the burning of the protecting forest cover, becomes readily water-soaked and unstable, giving way every here and there and sliding into the river bed. Eight miles from the mouth the Odei river, a smooth-flowing stream of considerable size, comes in from the west on the left bank, occupying a well marked valley with clay covered hills rising to heights of a hundred and fifty feet on both sides. A few miles further up the river, above a series of short rapids, the immediate banks are low, rising by a gradual slope six to twenty feet above water level, and then extending back with a moderate slope for from two to three miles, where a height of about a hundred feet is reached. Much of this land is, apparently, well adapted for cultivation; the clay is entirely free from boulders and mixed near the surface with enough vegetable humus to produce a friable and seemingly productive soil. The gentle slopes give good natural drainage, and the open character of the forest makes it a country easily cleared. But little timber is left of a size larger than eight inches in diameter three feet from the ground; all the dryer parts, denuded of old forest by the repeated fires that have swept over the region being covered by forests of only ten years' growth or younger.

'For the next nineteen miles the river valley and neighbouring country present the same general aspect. Here the valleys of the main river and the Odei approach one another, separated only by a dividing ridge a little over a mile across and a hundred and fifty feet high. The ridge is clay covered to the flat summit where knolls of... gneiss project.... Beyond the valley of the Odei, to the north, is a rolling, forested country, the hills clay covered to the tops, rising by gradual slopes to about a hundred feet above the intervening valleys that are themselves from twenty to fifty feet above the river level. The forest is mainly spruce and tamarac of about sixty years' growth, the larger trunks reaching diameters of from eight to ten inches, but the general average not more than six inches. In the valley, occasional white spruces and tamaracs attain diameters as great as eighteen inches. These are trees that have escaped when the surrounding forest was burned, and are sufficient evidence that, but for the repeated fires, there would be large areas covered with good timber.

'For the next twenty-eight miles the river, flowing in a rock-bound basin, has the character of a long, narrow lake from half a mile to over a mile in width. Covering the well-rounded ledges of gneiss that form the immediate shores, is the same thick mantle of clay, forming a country of very attractive appearance. Rising gradually from the river level to heights of from twenty to fifty feet, a flat or gentle sloping plateau extends back from two to three miles to another rise, where the general level is increased to about a hundred feet. Recurring forest fires have not only denuded this section of its trees, but even the stumps have for the most part been burned away, so that it is now covered only by an open growth of small white birch, poplar, willow and Banksian pine, with an undergrowth of vetches and grasses and small shrubs. Just above is the Manago Fall where the river pitches over a ledge of gneiss with a vertical descent of thirty feet.

'The probable course of a railway through this country would cross the river at one of the rapids below Manago Fall, where ledges projecting from either shore give good foundations for piers, and follow the north side of the river valley along the plateau land, described above, to the valley of the Odei, which would be crossed near where the two rivers approach one another. This would afford fairly deep water con-

nection with Split Lake and the Nelson River, and their sturgeon fisheries, by way of the deep and smooth-flowing Odei and Burntwood rivers.

Above Manago Fall the river expands again to form a long, narrow lake for the next ten miles of its upward course. The same rolling clay plateau extends back from both shores of the lake, rising gradually to an undulating higher tract perhaps a hundred feet above the lake level. The forest growth is still very open, allowing a good surface carpet of grasses, vetches and other vegetation. Diversified here and there by small open tracts, where the grass covered surface is free from trees; this country often presents quite a park-like aspect. Throughout all the clay covered region the absence of erratics is striking; for miles no perched boulders nor transported materials of any kind, other than the lacustrine sediments, are seen, and even the country rock is deeply hidden under the heavy clay deposits that seem to be very homogeneous throughout, not laid down in thin layers as in the case of many clays of apparently similar origin in Eastern Canada, but, if stratified at all, only in very heavy beds that seldom show their bedding planes.

For the next fifteen miles to Waskwatin Lake the river has a quicker descent and its course is broken by several small rapids. The surrounding country is slightly higher, rising in places about two hundred feet above the river and more steeply from its shores. From the south shore a clay covered bench a quarter of a mile wide, rises to a comparatively steep slope to a height of a hundred and thirty feet, and extends back for miles, at about that level, with a gently undulating surface, free from boulders or rock, excepting very rare exposures. As a matter of fact, but one small knoll of the underlying rock was actually seen, rising through the clay at a point about two miles back from the river. The low flat along the river is covered by a sixty years' timber growth, mainly of Banksian pine and spruce. The higher plateau is wooded principally with spruce from six to eight inches in diameter, with scattered Banksian pines, poplars and white birches succeeding an earlier burned forest that was even younger when destroyed, and this following a still earlier that, by the stumps, is shown to have been somewhat larger. Evidently this country has been subjected to repeated burnings that have followed one another, often at intervals of comparatively few years. The areas of muskeg on the upland do not seem to be extensive, and no gravel beds nor boulder ridges were seen. The Indians report that this plateau-like country extends right across to the valley of Grassy River with only gently swelling ridges and no high hills.

Waskwatin Lake has been described by Mr. J. B. Tyrrell as 'a very pretty sheet of slightly murky water, six or seven miles long and three miles wide, surrounded by sloping clay-covered hills wooded with white spruce and poplar, its surface varied by a few islands composed of clay overlying a floor of gneiss.'

Two falls near its outlet would, in Mr. Tyrrell's opinion, 'furnish a large amount of power for driving mills or machinery of any kind.' A supply of timber for building and fuel could be obtained from the surrounding country; 'and the soil,' he assures us, 'would grow any of the ordinary roots or more hardy cereals.' He concluded that it was 'not improbable that before long, when this fertile country is made accessible by the advent of a railroad from the south, one of the most prosperous towns in the district may grow up on the shore of this now secluded lake.'

Mr. McInnes thought the lake somewhat larger—eight miles by four—with a long bay extending to the west from its southern end. He thus describes it: 'The waters are but slightly turbid from suspended sediment and abound in whitefish (of good quality) and small sturgeon. On all sides of the lake are large tracts of nearly level clay land extending back for several miles at heights of from fifteen to fifty feet above water level and beyond that continuing at a level of a little over a hundred feet. A mixed second growth forest, mainly aspen poplar, covers all the uplands, while on the islands and on low flats bordering bays of the lake are found white spruces and poplars of diameters up to one foot. The grass-covered slopes that rise with very gentle gradients from the shores of the lake, make this a country of most attractive appearance and one that apparently would be well suited for cultivation.'

The Indian inhabitants of this section cultivate with success small garden patches of potatoes. "Bordering many of the bays of the lake are sand beaches.....made up principally of garnets and other Archæan detritus, but containing also limestone pebbles derived from the Hudson Bay basin."

Continuing along the river, Mr. McInnes describes the country as being of 'the same general character' for thirty miles, 'covered for the most part with a mixed second growth from ten to thirty years old, but with here and there clumps of white spruce, with tall and straight trunks, a foot or more in diameter....On the shores of Footprint Lake, in latitude 55° 45' small fields of potatoes planted by Indians were looking remarkably well, the vines being eleven inches in height and about ready to blossom' when this locality was visited on July 10th. Above the lake broad flats extend back from the river on both sides, rising from half a mile to a mile back to fifty feet above the river. The greater part of the flats and practically all the highland have been burned over within twenty years, and are clothed now with an open growth of small mixed timber; the land is free from boulders and gravel and has a good carpet of native grasses, including such good meadow forms as the blue-joint and the wild rye. 'The open character of the forest permits a somewhat luxuriant growth of these grasses, mixed with vetches, strawberry vines, &c., and with currant, gooseberry and other small shrubs and bushes.'

To the southward of the most southerly bend of the river he found the land rising with a comparatively steep slope to a height of sixty feet above the river, and extending back 'as a level clay-covered plain with about five inches of clay-loam soil, well mixed with vegetable matter, gradually merging downwards into pure clay.' This 'plateau has a gently rolling surface, the bottoms of the hollows, where small areas of muskeg often occur,' being 'forty feet lower than the slopes of the ridges,' the 'highest land reaching not more than a hundred feet above the river.' For six miles back there prevails 'higher land, wooded with Banksian pine, poplar and spruce and diversified by many open grassy glades.' The areas of what is called muskeg here are 'rather grassy marshes,' than peat bogs, and are 'comparatively insignificant in extent.' But beyond this tract 'broad belts of wet, grassy marsh land extend southwesterly across to the heads of brooks running into Grassy River below Wekusko Lake and form practically the western limit of the clay-covered uplands, though in the river valleys and along the flanks of their bordering hills the clay land extends much further west.'

TEN THOUSAND SQUARE MILES OF CULTIVABLE LAND.

In summing up his impressions of what he designates the 'gently rolling clay-covered country,' Mr. McInnes writes: 'Of the whole of this extensive plateau land, extending from the valley of the Nelson River westward to near Burntwood and Wekusko Lakes (west long. 99° 45'), northerly at least to beyond latitude 56°, and southerly to the limestone escarpment, an area of about 10,000 square miles, it may be said it is characterized by a heavy clay soil entirely free from boulders. Lacustrine clays, composed of the rock flour once held in suspension by glacial streams and deposited by them as they reached the quiet waters of a great lake, are essentially the soils of this region; there is no distinct surface soil clearly separable from the clay subsoil, the one merges gradually into the other, the clayey character of the soil being strongly apparent at the very surface where merely the shallow cover of decaying leaves and other vegetation is scraped away. Generally for from five inches to over a foot down the clay is deep brown in colour from the admixture of vegetable matter and quite friable, and the rootlets of even the smaller surface vegetation reach down far below this level, though on the tops of many of the ridges the light buff-coloured clay, without any appreciable coloration from vegetable matter, comes to the surface. The rolling character of the plateau generally provides fair drainage, but over considerable areas in its central portion, far from the valleys of the larger

streams, there are large tracts that have not sufficient gradients for the proper flow of the surface water, but could be made available for agricultural uses by being artificially drained.'

THE COUNTRY ONWARD TO THE SASKATCHEWAN.

The western limit of 'the good country' is in about longitude $99^{\circ} 45'$, and then comes what Mr. McInnes describes as 'a typical Archaean surface, consisting of high gneiss hills, bare and rugged, with intervening deep and sharp valleys generally occupied by muskegs. On the steep flanks of some of the slopes Banksian pine and spruce grow to a fair size, but, owing to the thinness or entire absence of soil cover, the bare gneiss hills, devoid even of moss, are covered only by a scattered growth of small trees. Little flats along the river valleys are covered by clay forty feet or less. The clay deposits often become quite gravelly or give place to sand, showing probably an approach to the old shore lines of the lake in the deeper parts of which the heavy deposits of clay were laid down. On these tracts white spruces grow in diameters of from a foot to two feet, but the areas are very limited in size. This section of country.....embraces all the land extending from the escarpment.....of the limestones which follows a nearly east and west line touching the southern ends of Reed and Wekusko Lakes, indefinitely to the northwest; it has, generally, the same rugged character with but very limited areas that are fit for cultivation, and must be considered as valuable mainly in the possibilities offered by the Keewatin belts, that here and there traverse it, for the occurrences of valuable minerals. No mineral deposits of value were noted, though traces of copper were observed in the vicinity of File Lake.'

The country stretching from the south of this area to the Saskatchewan Valley 'contains,' according to Mr. McInnes, 'very few tracts of land suitable for settlement.' He continues: 'Practically only the river valleys, a few tracts adjoining some of the lakes and parts of some of the slopes flanking the limestone ridges, can be considered as affording land suitable for cultivation. The upland is generally almost bare of soil, flat-lying limestones forming its actual surfaces, and the slopes, though covered to a good depth by clay, are for the most part too bouldery for tillage. Limited tracts here and there occur suitable for individual holdings, notably near some of the principal lakes.' 'The larger of these, Atikameg, (locally known as the Clearwater), Cormorant and Reed Lakes, are very beautiful sheets of clear water, well stocked with fish, including lake trout and whitefish. All are skirted by the located portion of the line of the proposed Hudson Bay Railway, and may be expected with its advent to become favourite summer resorts for the people of the growing western cities.

'Atikameg, the most southerly, nearest to the Saskatchewan, is a very beautiful sheet of quite colourless, pellucid water about eight miles by eight, its expanse unbroken by islands and attaining in its central parts depths of upwards of a hundred and fifty feet. It is apparently fed, principally, by seepage through the gravels and by springs following the bedding planes of the limestones, from the Saskatchewan watershed, as no brook worthy of the name flows into it, though the overflowing stream is of good size even at lowest water.

'Cormorant Lake, into which the last named flows by a short stream with a fall of twelve feet, is about half as large again as it. Its water, though not quite colourless, is clear and free from sediment and its surface is diversified by many islands, some of large size. The islands are flat topped limestone ledges, generally showing low cliff faces rising from deep water, but varied by occasional sandy and bouldery beaches; they are well wooded and would furnish, many of them, ideal spots for summer residences.

'Reed Lake, the most northerly, lies just without the limestones that terminate in a low escarpment fronting its southern shore. It has about the same area as Atikameg, but of a much less regular outline, and the shores are fringed by more than a hundred small islands.

The hardy magnesian limestones or dolomites about these lakes would furnish good building stones, the natural bedding of the rocks causing them to break out readily into blocks from a foot to five feet in thickness and of almost any required sizes.

The valley of the Saskatchewan is here so low that it is annually inundated, except where infrequent ridges occur. The highest water is usually in July, when the river rises some eighteen feet above its low water line. Mr. McInnes writes: 'On the north side of the river at the Pas, beyond a low flat, a kame-like ridge, with a gravelly surface and clay and boulder cone, rising from seventy to ninety feet above the river, follows the course of the stream upwards for five miles to the Big Eddy, where it swings northerly and continues for another eight miles or almost to Atikameg Lake. This ridge forms a sort of natural highway, along which the Indians have a road to their autumn fishing grounds in the lakes, and which has been utilized by the engineers for the location of the railway line. Along the wider parts of the ridge and on the flat at its base are situated Indian and half-breed settlements, where the natives are generally living comfortably in good houses, many of them raising horses and a few cattle, but few paying much attention to the cultivation of the soil, contenting themselves with small fields or garden plots of potatoes and the commoner vegetables.'

TIMBER.

As to timber, Mr. McInnes reports: 'Over the whole region the areas of forest, where the trunks are large enough to be of commercial value, are limited, though, but for recurring fires in the past, there would be a magnificent forest cover over the whole area, stunted only on the muskegs and in the Archaean and limestone areas and on the hill tops, where the soil is wanting or too thin to support a good growth. The principal tracts of large, standing timber are situated to the north of Moose Lake, to the west of Atikameg, in the lower Grassy River Valley and on the ridge separating Cormorant and Yawningstone Lakes. The last named tract contains white spruce of exceptionally large size with tall clear trunks. Smaller areas are found on islands and points in the various lakes, along the upper valley of the Cowan River, and in clumps along the stream valleys in the district. Smaller timber, mainly black spruce, that would be of value for pulpwood, is much more widely distributed, occurring over wide areas.

'Over part of the Archaean area the white spruces are suffering from the attacks of fungi that infested the leaves, causing them to turn red and wither as though fire-killed. This fungus.....was found only on the white spruces, though it does not generally confine its attention to any one species of spruce. The injury to the trees will probably not be permanent, resulting only in most cases in a slight retardation of the growth.'

Mr. McInnes made a computation of the ages of the trees, and found that the annual growth is slow. They run from four to fourteen inches in diameter. They would furnish, he thinks, 'very strong and firm lumber, and the smaller trees, owing to their closely packed fibres and the comparative absence of open cellular matter, would be especially well adapted for the manufacture of pulpwood for paper making.'

FARMING.

Of the agricultural possibilities of the country Mr. McInnes writes: 'Experimentally but little is known of its capabilities, though we have instances here and there throughout the area, to beyond its northerly limit, of the cultivation of all sorts of garden vegetables, including, at the Pas, tomatoes and Indian corn. On the 6th of September of this year Indian corn was seen in Mr. Halcrow's garden at the Hudson Bay Company's post, well headed out, the ears large and full and quite fit for table use. The Indian, never a very enthusiastic agriculturist, succeeds every-

where in getting good crops of potatoes, and at the homestead of an old settler named George Cowan, on Cormorant Lake, an exceptionally good yield of very large potatoes was being dug in September.'

CLIMATE.

Mr. McInnes gave particular attention to the question of climate, which he rightly considered of 'vital importance in connection with this region.' He kept a careful record of temperatures, and from the time it was 'begun on the 19th of June until the night of the 29th September, when the thermometer fell to 26°, there was no frost that affected even tender vegetation. On the night of the 10th of August the temperature fell to the freezing point, but did not get low enough to do damage, at least in the valley of Grassy River, though some of the potato vines on the summit of the high ridge north of the Pas were slightly touched.' He was convinced that the 'district is not, at all too cold for general agricultural operations. The longer daily duration of sunlight in these high latitudes must be taken into consideration and for purposes of comparison with more southerly localities yearly averages of temperature are of no value. A region lying in a higher latitude, though showing a lower yearly average temperature, may during the growing months, owing to its longer hours of sunshine, have quite as good an average.' His record showed that 'during July the temperature at 6 o'clock p.m. was equal to or higher than the noon temperature on fifteen days; during August on nine days and during September on eight days, and the 6 p.m. averages for these months were lower than the noon averages by only 1°, 1½° and 2° respectively.'

For the purpose of comparison, Mr. McInnes procured from the Director of the Meteorological Service at Toronto an abstract of the past summer's temperatures at Minnedosa, Stony Mountain, Hillview and Brandon, and comparing them with his record he concluded that the country along the route of the proposed railway to the bay is 'conspicuously warmer than the same latitude four hundred miles further east.'

FACTS GATHERED BY MR. MCLAGGAN.

Last summer and fall, Mr. J. W. McLaggan, of Strathcona, Alberta, made an exploratory trip over a portion of the same country, going further west than Mr. McInnes. He left Prince Albert on August 2nd and reached the Pas on the 15th. On the 25th he crossed Clearwater Lake. He describes the country he passed through as low and swampy, with small, mixed timber; the shores of the lakes as rocky and of limestone formation; the waters as abounding in trout, whitefish, jackfish and pike; and wild berries of all kinds as plentiful.

On the north side of Cormorant Lake, and along the creek which connects it with Lake Yawningstone, and on the south side of the latter lake he saw from three to five million feet of good milling spruce timber.

The land north of Cormorant Lake he found to be of good clay loam, and capable of being farmed successfully on a small scale after being cleared. A garden of potatoes, turnips, carrots and cabbages looked well and on the 27th of August showing no evidence of frost.

Along Cowan River the country is described as low and flat, with small quantities of good spruce timber in spots until within a few miles of Black Duck Lake when bunches of good spruce, estimated at ten million feet, come into view. The land is of clay loam mixed with sand, and in Mr. McLaggan's opinion only fairly fit for farming. Part of it would, if drained, make hay land.

After crossing Black Duck Lake the country continues low and marshy, with scattered bunches of spruce and tamarac of a size suitable for ties or pulpwood. There is limestone on the shores of the lake. On the upper Cowan River there are small hay meadows; the rest of the land is poor and hard to clear.

As Mr. McLaggan approached Reed Lake he passed through low and swampy country covered with scrubby timber; the soil being a clay loam, which could be farmed if drained.

The lake is studded with many islands and replete with large trout, whitefish, pike and pickerel. To the south, about a million feet of medium sized spruce was sighted. The country back was found to have been burned over and now growing poplar which, in a few years, will make good pulpwood. In this section the country is very rocky. Dark coloured granite, streaked with white quartz, extends along the lower end of the lake and for six miles along the river. Four miles further, Mr. McLaggan found indications of iron and saw a good water power.

Above Herb Lake he saw another splendid water power, very easy to develop, and, along the river below, five rapids from which fair power could be generated. On the north side of Herb Lake there are spruce and poplar fit for railway ties and pulpwood, and along the river to the rapids there are small bunches of jackpine and tamarac and of merchantable spruce; but back from the lake and river the country appeared all burned. Mr. McLaggan expresses the opinion that there must have been a good timber area bordering these waters, and that, if fire can be kept out, reforestation will soon be effected.

At the lower end of the lake and along the river, granite mixed with white quartz was seen, and at the falls in the river, about twenty miles below the lake, good slate was found. The country is rocky, with patches of fair land, suitable for raising vegetables and garden produce.

When the rapids of Grass River are passed the country becomes low, but in places there is good soil of clay loam mixed with sand; and towards Setting Lake there are good hay meadows. In places along and back from the river, on either side, quartz was seen. The country has been burned over, leaving only a few bunches of spruce, and the surface of the rock has been well exposed, so that prospecting would be easy. Mr. McLaggan thinks that this part of the country may prove rich in mineral.

Grass River, where it broadens into the long stretch known as Setting Lake, is described by Mr. McLaggan as one of the most beautiful sheets of water he has ever seen and quite comparable to the St. Lawrence where it passes through the Thousand Islands. He looks forward to it becoming a great summer resort. Along the shores of and on the islands in Setting Lake there is, he estimates, about ten million feet of young, sound, clear spruce timber, averaging from twelve to fourteen inches in diameter.

Between Setting and Paint Lakes are two falls of thirty feet, where splendid power can be developed; the banks of the river become higher and there are small bunches of spruce and poplar, but back from the river has been burned over; the country is very rough and rocky, but there is some good land.

On the 10th September, Mr. McLaggan reached Paint Lake. The weather was fine and warm. Quartz was still in sight, but not so frequent in occurrence. There are a number of islands in the lake with rocky shores and small, mixed timber. On the south side of the lake there is a fairly good bunch of spruce, suitable for railway ties or pulpwood. Back from the lake the country has been burned over but is growing up again with poplar and other trees. To the north there is a limited quantity of good land.

Mr. McLaggan returned up the river to Reed Lake. In re-crossing Herb Lake he noted further indications of iron, and formed the opinion that iron would be found in that part of the country. He portaged from Reed to Methy Lake, and found the land of little value for farming, the timber mainly jackpine and tamarac of small size, a limited portion of which would be fit for railway ties. The shores of the lake are low and rocky, and on the south side have showings of white quartz. He crossed the lake and traversed the File River to Burntwood Lake. He does not consider the country as good as that through which the Grass River flows; low muskeg and rough rocks alternate. With the exception of a bunch of spruce of about half a

million feet, averaging twelve to fourteen inches in diameter, there was seen nothing but small, scrubby mixed timber of but little value. The country back from the river has been burned over.

Between Reed Lake and Elbow Lake he saw about two million feet of good spruce and poplar, averaging from twelve to fourteen inches in diameter. There are some small spots of good land, but as a general thing the country is rough, rocky and swampy. The back country has been burned over. Below Elbow Lake the river banks are high, the country becomes rougher, and fire has bared the rocks of soil. White quartz crops out in considerable quantities. The country between Elbow and Cranberry Lakes is mainly muskeg. Towards the lower end of Cranberry Lake there are bunches of good spruce. It is estimated that there is a million feet in all. The country continues rough and rocky, with patches of good land and some muskeg.

The country between Cranberry and Athapupuskow Lakes is rough and rocky with some hay meadows and muskeg and a poor growth of scrubby timber. Some small bunches of spruce were seen along Athapupuskow Lake near the portage, and by the Goose River, but the country has been all burned over, leaving only small clumps of spruce. The river is very shallow and so teems with whitefish that they seem to cover the bottom and can be killed with sticks. There are some parcels of fairly good land along the lower part of the river, but the country generally is rough and rocky.

The country about the upper end of Goose Lake was found to be boggy and so of very little use. The greater part of the country has been burned over, leaving only clumps of spruce and poplar. On the south side and at the west end of the lake limestone occurs. Along Goose River, below the lake, there is quite a tract of fairly good land, and there is another on the Sturgeon, between the mouth of the Goose River and Cumberland Lake. The soil is a clay loam mixed with a little sand. It is covered with brush and small poplar and would be easy to clear. Along the banks of Cumberland Lake there are considerable quantities of limestone, which 'may become very valuable in time.'

Mr. McLaggan found game in great plenty and 'immense waters teeming with fish.' Of the agricultural, timber and mineral possibilities of the country, he writes:

'As a farming country: The summer seems to be good and where good land is found there should be no trouble to raise good crops of all hardy grains and vegetables, but the greatest drawback to farming would be the difficulty of making wagon roads from place to place, as the country between the spots of good land is rough and rocky.

'As a lumber country: The fires seem to have burned over nearly all the country and I was not able to walk far enough into the interior to find any land not burned, and from information gathered from Indians and trappers, would conclude that this burned land reached from the Grass to the Burntwood River, with the exception of small pieces along the lakes and rivers. There is a growth of young timber coming up, since the fire, which may be of value in time.

'As a mineral country: There is a wide field for prospectors. In the country travelled over there are indications of gold, silver, iron and limestone; and Indians and white men from the north tell wonderful stories of a place called Indian Lake, north of Nelson House, and of an island on Burntwood River where various minerals and oil are said to exist.'

The climate seemed good to Mr. McLaggan in the first week of September. The foliage was green; there was no sign of severe frost, and butterflies, hornets and other insects were numerous and active. The first frost noted was the 31st August, 'but not enough to damage wheat.' The weather was fine in the morning and it rained in the afternoon. Near Cormorant Lake he saw, on the 27th August, a garden of 'potatoes, carrots, onions, turnips and cabbage doing well with no sign of frost.' On September the 13th he noted that the weather was fine but cold, with a heavy frost in the morning; that the leaves were falling, and that it began to look like autumn. Considerable rain followed, which, on the 4th of October, gave place to

snow, to be followed again by rain. The night of October 7th is noted as the first really cold one of the season; but the morning brought rain. There was snow again on the 8th with high wind and ice on the water along the shore of Goose Lake. It was 'fine and warm' on the 11th, and 'clear and cold' on the 13th when he reached the Pas on his return.

A NORTHERN MISSIONARY'S STATEMENT.

The Rev. John Semmens, who spent many years as a missionary in the north country, went to live on the banks of the Burntwood River, at Nelson House, in the year 1874. He remained there two years; and for a number of years thereafter paid occasional visits to the locality and made journeys through the adjacent country. He writes:

'The most of my tripping was between Norway House and Nelson House, though I have been as far north as Indian Lake, as far west as Nelson Lake, and as far east as Split Lake. The information I have to offer, therefore, concerns the lower reaches of the Burntwood after its junction with the Rat River at Nelson House.

'Much of the country specified is hilly, with frequent out-cropping of granite rock, and some large tracts of muskeg or swamp land; but there are found large areas of open country, and valleys of tributary rivers, where the soil is rich and deep and where grazing and stock raising could be very successfully carried on. The sheltering forests, and the abundant water courses, the numerous beaver dams, and the rich native grasses would indeed make this locality ideal to sheep raisers and general ranchmen. The absence of anything like a market has hitherto kept this country from being reported of, but if a railway becomes an actual fact, Manitoba will add very much to her available resources, when extension comes, and settlers will find that in soil, in wood, in grasses, and in waters, this unknown land will afford comfortable homes for thousands....

'It will be seen by the map that about 100 miles down the Nelson all the branches of that noble river unite in one. From that point we are accustomed to strike across country to Landing Lake, Wintering Lake, Pipestone Lake and thence into the Burntwood River. This short cut has along its course many thousands of acres, such as I have described, and for fishermen as well as ranchers must some day be a paradise.

'As Nelson House is but 225 miles inland from Hudson Bay there is rather a large snowfall some years. The moisture of the bay is carried westward by the strong east winds, and deposited on the hills and valleys to the depth of three or four feet. This heavy fall becomes less and less the further one proceeds from the coast line. This is the reason why the jumping deer by the thousand forsake the shores of the bay in winter and take to the sheltering valleys of the interior.

'The cold at Nelson House is no more intense than that of a winter in northern Manitoba as at present constituted, but the frost sets in rather sooner, and tarries rather longer than it does at the north end of Lake Winnipeg. Roots and vegetables planted about the 24th of May do well and are gathered about September 15th. The presence of so much water so regulates the temperature that there are few frosts either early or late to make growth uncertain; yet, in my experience, wheat is not a sure crop. All depends upon the season. Oats and barley will do well any time.

'There is a good deal of timber in the valleys and on the islands and lakes of the Burntwood River-course, though it is sprucey and inclined to be small. I have cut timber as large as two feet in diameter at the butt and fifty feet in height, but this is exceptional. From ten to fifteen inches near the ground is a better estimate of the average size of the trees.

'The very name of this river suggests the historic fact that the natives of the country deliberately and habitually set the woods on fire, their object being to attract the deer which are known to be fond of the sweet grass which springs from the ashes of a fire swept surface. The result is that large tracts of country are denuded of their rich first growth of trees, and young forests are just coming into the middle

stages of growth, while many of the hills stand bald and bare, giving silent evidence of the severity of successive visitations of the devouring flame. Yet the charred stumps and tangled roots here and there speak of a deep and fertile soil, as well as of possibilities of growth which few have associated with a so-called 'frozen north.' However, all the timber necessary for railroad purposes and for the use of settlers in building or for commercial cordwood can be found almost anywhere, the latter in illimitable quantities.

'It was not my business to seek for minerals, but having been a miner in earlier years I had my eyes open and found many indications of deposits which, in my opinion, at no distant day will contribute largely to the commercial development of the north. I shall be surprised if one of these lodes is not found at or near the southern outlet of the Beaver Dam Lake. And there will be many others.'

CAPTAIN ROSS' DESCRIPTION.

Captain H. H. Ross sailed the steamboat *Cumberland* for the Northwest Fish Company on the Lower Saskatchewan River and adjoining waters during seasons of 1903, 1904 and 1905. He knows well the Saskatchewan from Grand Rapids to Cumberland House, Moose Lake, Sturgeon Lake, Cumberland Lake, Cormorant Lake, and the intervening waters. He describes the river at the Pas as being about seven hundred feet wide, with gravelly shore and high banks, sloping about one hundred feet back on the north side, and on the south side rising to about forty feet high, and bordered with good land and timber. The climate, he says, is good. There are about four hundred Indians and some half-breeds at the Pas. They live on trapping in the winter and in the summer they fish for the fish companies and for the Hudson Bay Company. They raise potatoes and seem to do very well.

Back from each side of the Pas there is nothing but swamps, but there is a ridge of high land running, says Captain Ross, from the Pas right through the country. He describes the country around Cormorant Lake as muskeg, with good timber; and the Moose Lake country as much the same, but with high, rocky shores.

Captain Ross in 1906 went down the Nelson River in a canoe, reaching Split Lake in July. There are many rapids and the country is mainly muskeg with small timber. Between Norway House and Split Lake the country resembles the Rat Portage district, and the Captain found people prospecting for gold.

The country along the small rivers, after leaving Nelson, is muskeg, with small timber and jackpine, and no high land; the high land is farther west. There is a good amber deposit at Cedar Lake now being worked, Captain Ross understood, by Americans.

THE NELSON AND THE COUNTRY TO THE EAST.

In 1878, Dr. Bell made a track survey and geological examination of the boat route from Lake Winnipeg to Hudson Bay, by way of Oxford House and Knee Lake and the rivers thence to York Factory. He also made topographical and geological surveys of the lower part of the Nelson River and of the upper part of the same stream from Lake Winnipeg to near Split Lake. In 1879, he entered the country via Norway House to complete those surveys and to examine the Churchill River.

The forests and the flora generally of the Nelson River region indicated to him 'a milder climate than that of the corresponding tract on the opposite side of Hudson Bay' and this he considered 'at least partly due to the southerly winds which prevail in summer, bringing the warm air, probably from the valley of the Mississippi down that of the Red River and over the whole length of Lake Winnipeg, which has a high and even temperature during the summer months,' a condition which he thought prevented the occurrence of summer frosts in the Norway House region, which appeared to him 'to enjoy a climate fully as good as that of the Province of Manitoba.' In that region he found small fruits, cucumbers, musk-melons and

vegetables of all kinds 'coming to maturity in good time.' 'Barley' he regarded as a 'sure crop.' There was 'no object to be gained in attempting the cultivation of wheat,' but he concluded that there was every probability that it would succeed, as this cereal is known to come to great perfection in the Athabasca and the Peace River regions, in localities more than a thousand miles to the north-north westward.

The climate of this region was to him, 'pleasant in summer, without an excess of rain, and he was told that in winter 'the weather, although cold' was 'bright and uniform, with only a moderate amount of snow.'

'The land,' he wrote, 'would be easy to clear of timber, and, considering the unlimited supply of wood for building purposes, fuel, &c., the prevalence of good water, in which a variety of excellent food-fishes abound, as well as the greater proximity of this region to Europe, it offers some inducements to immigrants which are not to be met with in the greater part of the prairie country to the westward.' He thus continued his description of the country :

'At Oxford House, barley, peas, beans, root-crops, vegetables and hay thrive well, and the surrounding district might make a good dairy and stock-farming country. Even as far as York Factory, potatoes and some kinds of vegetables may be successfully cultivated. Large areas of low sandy land occur on Oxford and Knee Lakes, especially on their northern sides. These tracts support a uniform growth of small spruce timber through which the forest fires have generally run. The higher grounds, where not rocky, present usually a stiff light-coloured clay, and soil of this description with more or less loam, is found along the valley of Trout River. Oxford House is situated on a stiff clayey soil, which here produces barley and all kinds of garden vegetables in perfection. This locality is remarkable for its abundance of wild gooseberries, acres of ground in some places being covered with gooseberry bushes. The land to the north of the lake, opposite to Oxford House, rises to an elevation of about 200 feet, and appears to be higher than any other ground in this part of the country. I was informed that it consists entirely of soil underlaid by drift materials, no rock cropping up in the vicinity.

'The soil or loose materials consist of loam, clay, sand and gravel, or of a mixture of them. Peat and sphagnum are found in the low grounds in many places. On the northwest side of Swampy Lake, below Knee Lake, there is a bed of good peat of considerable extent, which shows a perpendicular face of four or five feet above the level of the water. Peat of fine quality occurs at Clearwater Lake and Swampy Portage Lake.'

Mr. Cochrane, who was one of Dr. Bell's party, explored a part of the country himself, and after going over the country about Island Lake he made this note in his field book: 'The soil I have seen in passing round the lake is very good indeed, being generally clay of a light brownish colour, mixed in most places with a little fine gravel. In nearly every case where I went inland for any distance, the rock seen along the lake shore disappeared or was covered with soil, and the trees were of a larger and better growth than near the water. There is a very good garden at this post, and certainly I have never seen potatoes look better than they do here.'

THE VIEW OF THE REV. DR. JOHN McDUGALL.

Rev. Dr. John McDougall, a pioneer missionary of the West, thus describes the country to the south of Split Lake: 'There are but two seasons there—summer and winter—each fitting into the other with little or no spring or fall. This, to a large extent, does away with the broken weather which is so often experienced in the east at the changing of the seasons, and makes the conditions more favourable for settlement. The winter is steady and pleasant, and although cold, is not nearly so severe as is generally supposed. In fact, the climate is far more moderate than in southern Manitoba, the home of "No. 1 Hard" wheat. The summer begins early and the

growth and vegetation are almost of a tropical character. This is attributable to the longer hours of sunshine that prevail and to the proximity of streams of living waters everywhere in the district, each of which is conducive to plant nourishment.

There is considerable rock throughout the section, which indicates in the near future, a season of development for the mineral prospector, but there are also countless acres of good land which can be easily made to yield fruitful returns to the farmer, as has been the case southward in Manitoba and westward in Saskatchewan and Alberta. The soil is of clay sub-strata with sandy loam on the surface, and, although wooded to a considerable extent, is a far more enticing agricultural proposition than that which faced the early settlers on the bush farms of Ontario and other eastern provinces fifty years ago; and, with the advent of railways, a better market than the eastern settler had would be always available. The district in which are situated Norway House, Cross Lake, Oxford House, Island Lake, Nelson House, and Split Lake, covers a wide area, and at each of these places garden vegetables and grain for personal requirements have been successfully grown for a term of years. Summer frosts are practically unknown and the germination of vegetation, owing to the long hours of sunshine, is exceedingly rapid.

FROM SPLIT LAKE TO CHURCHILL.

The country between Split Lake and Churchill, along what would be the railway route, was explored last summer by Mr. Owen O'Sullivan, of the Geological Survey. He reached the lake on the 3rd July and left Churchill on his return on the 5th August. In his report of the 17th November, he describes the country about Split Lake as undulating, the rocks gneiss and granite covered by good clay soil, with occasional swamps, and the timber chiefly black spruce of from four to ten inches in diameter. A portage of a mile and three quarters leads mostly through swamp to a lake forty feet above the level of Split Lake. The country to lake Assean continues swampy, but there are two narrow clay ridges running east and west at an elevation of fifteen feet. The lake is about twelve miles long and one mile wide. Its shores are rocky, mostly gneiss, and are well wooded with black spruce, tamarac and white birch. A couple of years ago a fire ran from its southeastern end for several miles eastward.

The small and crooked Omatouwi River leads to the lake of the same name, fourteen miles distant from Assean. Omatouwi Lake is three miles by one, and on its west shore, about a mile from the inlet, mica and schist occur. Lake Waskaiowaka lies six miles north. To reach it five portages have to be made. No rock exposures were noticed by Mr. O'Sullivan, and he describes the country as low and swampy up to the last two portages, where hills of clay rising thirty feet above the lake's level extend east and west. Mr. O'Sullivan writes: 'The canoe route from the last portage follows the eastern shore of Waskaiowaka Lake for six miles in a northerly direction to its outlet, called the Little Churchill. Waskaiowaka Lake is about sixteen miles long. It has two expansions, the one on the south being about ten miles in length by five miles in breadth. A short narrows connects it with the northern expansion, which is about six miles long by four wide. The rock is generally gneiss and granite; clayey hills, rising to fifty or sixty feet above the level of the lake, form the southern shore of the northern expansion. Three miles south of the inlet, on the east shore, steep banks occur, covered with ten feet of mossy peat. The forest growth is chiefly black spruce and white birch of from four to fourteen inches in diameter.'

'Starting down the Little Churchill we traversed a swampy country for four miles; here the river expands, forming a lake two miles long and one and a quarter wide. On the east side, near the outlet of this expansion, a hill of drift covered mostly with black spruce, averaging eight inches in diameter, rises for two hundred feet above the level of the water.'

'Three miles farther down, the Beaver River, one chain wide, comes in from the northwest, and one mile below it the first portage was made, passing to the left of a

strong rapid giving a total fall of seventy feet in a distance of twenty-three chains. For a distance of seven miles from here down the river, only two portages were made, the longest one measuring twenty-four chains with a total fall of fifteen feet. Half a mile below this last portage, a cross section of the river, taken on July 14th when the water was at medium summer level, gave a flow of 150,000 cubic feet per minute as the mean volume. Six miles of swift current from this point brought us to comparatively still water, the river again spreading out and forming many expansions and islands until Recluse Lakes (called Waskaiowaka by the natives) are reached, a total distance of forty-five miles from Waskaiowaka Lake.

The country on both sides of the Little Churchill, so far, is generally rocky and swampy, with black spruce, white birch, and tamarac of small size. At the forty-second mile, the Switching River comes in from the west. This river has an approximate volume of 75,000 cubic feet per minute. Beds of peat of from two to eight feet in thickness, overlying permanent ice, were noticed at several places in this last stretch.

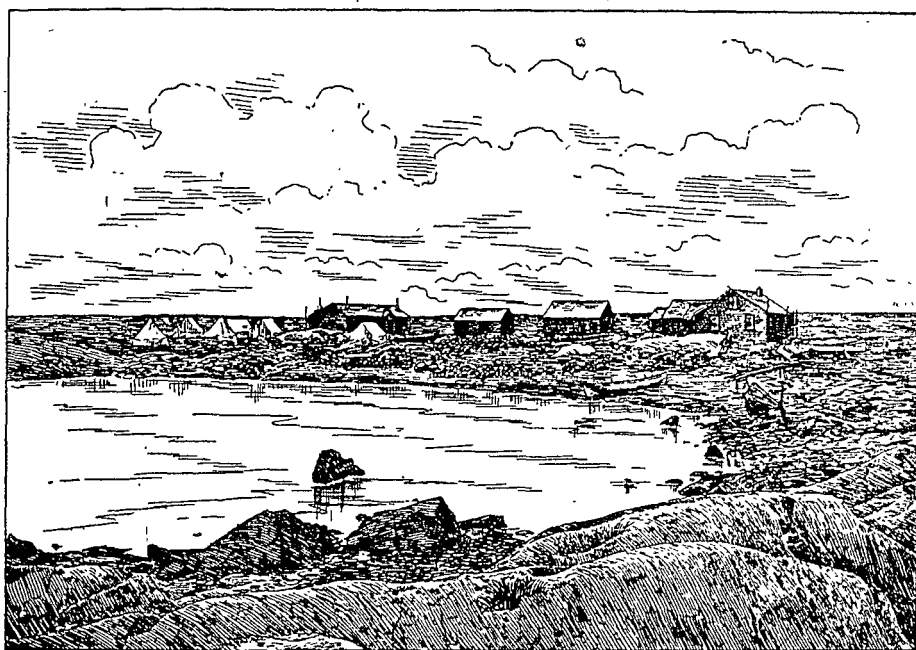
On entering the Recluse Lakes the east shore follows an expansion a mile and a half long by a mile and a quarter wide; then occurs narrows a mile and a quarter long, leading to the northern part of the lake, which runs east and west for four miles and has an average breadth of thirty chains. From the forty-seventh mile at the outlet of Recluse Lake, we made two short portages and ran a strong rapid, giving a total fall of twenty feet in a distance of half a mile. The last portage on the Little Churchill was made at a point two and a half miles below this rapid. From here the general course of the river, which is nearly due north, keeps a uniform width of about three chains with a swift smooth current to its junction with the Great Churchill, a total distance of 126 miles from Waskaiowaka Lake.

Gneiss and granite are seen in many places, particularly in the portages on the upper part of the river; there were no rock exposures seen below the last portage. At eighty miles down, a good view of the country was obtained from the top of the clay hill, seventy-five feet above the river. From this hill, the Little Churchill could be seen running through a valley about six miles wide to the foot of morainic clay hills which rise to 300 feet above the river. From this point northward the country, which has been overrun by a fire that occurred some forty years ago, is now partly covered with bunches of second growth black spruce, tamarac and white birch.

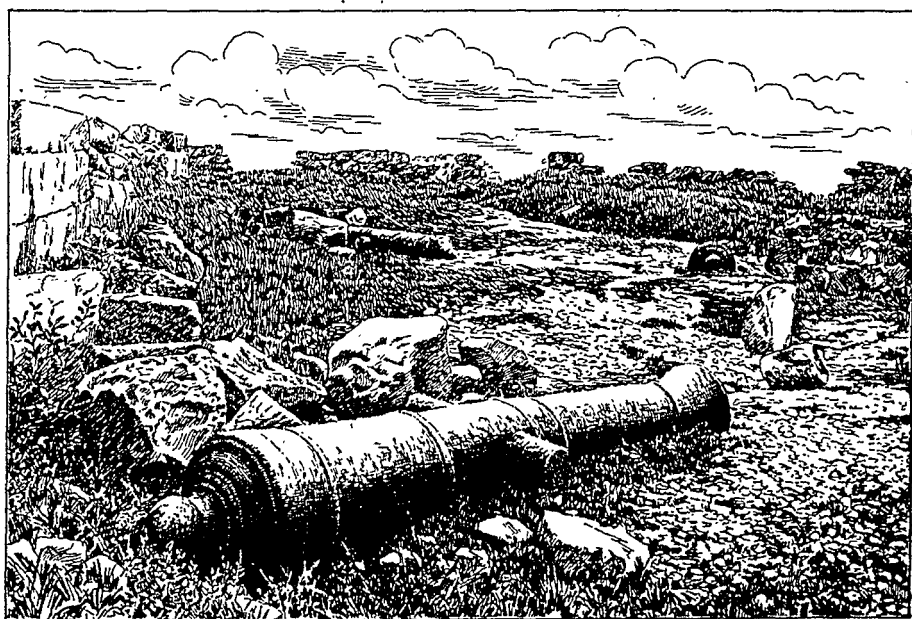
In order to reach the headwaters of the Deer River, Mr. O'Sullivan left the Great Churchill, made a portage a mile and a quarter long in a due east course over a hill having an elevation of 300 feet above the river, and reached a lake half a mile in diameter with banks of peat of from three to seven feet in thickness, overlying permanent ice. From this lake another portage, ninety chains in length, over a peat bog was made to a lake a mile and a half long by half a mile wide. Then, by a third portage one mile long over a short and steep hill, across a mossy black spruce swamp, he reached Deer Lake, the headwaters of Deer River, which runs northwest and southeast; it is two miles long by half a mile wide, with low banks of moss. Clay hills having an elevation of 300 feet above the lake are seen three miles to the northward. Lower clay hills occur all along the upper part of the Deer River for thirty miles down from Deer Lake, which is 110 miles in length and runs in a northeasterly direction. It is very crooked, and its swift shallow waters occasion many rapids. Mr. O'Sullivan continues:

With the exception of a yellowish limestone in the bed of the river eighty-seven miles down from Deer Lake, no outcrop of rock was noticed. The river from here down to the great Churchill flows over limestone; numerous large fragments of limestone were seen all along, and, with our paddles, we could feel the solid rock in many places at about three feet under water. The whole country has been overrun by fire. Bunches of spruce and tamarac that escaped the fires were frequently met close to the water's edge.

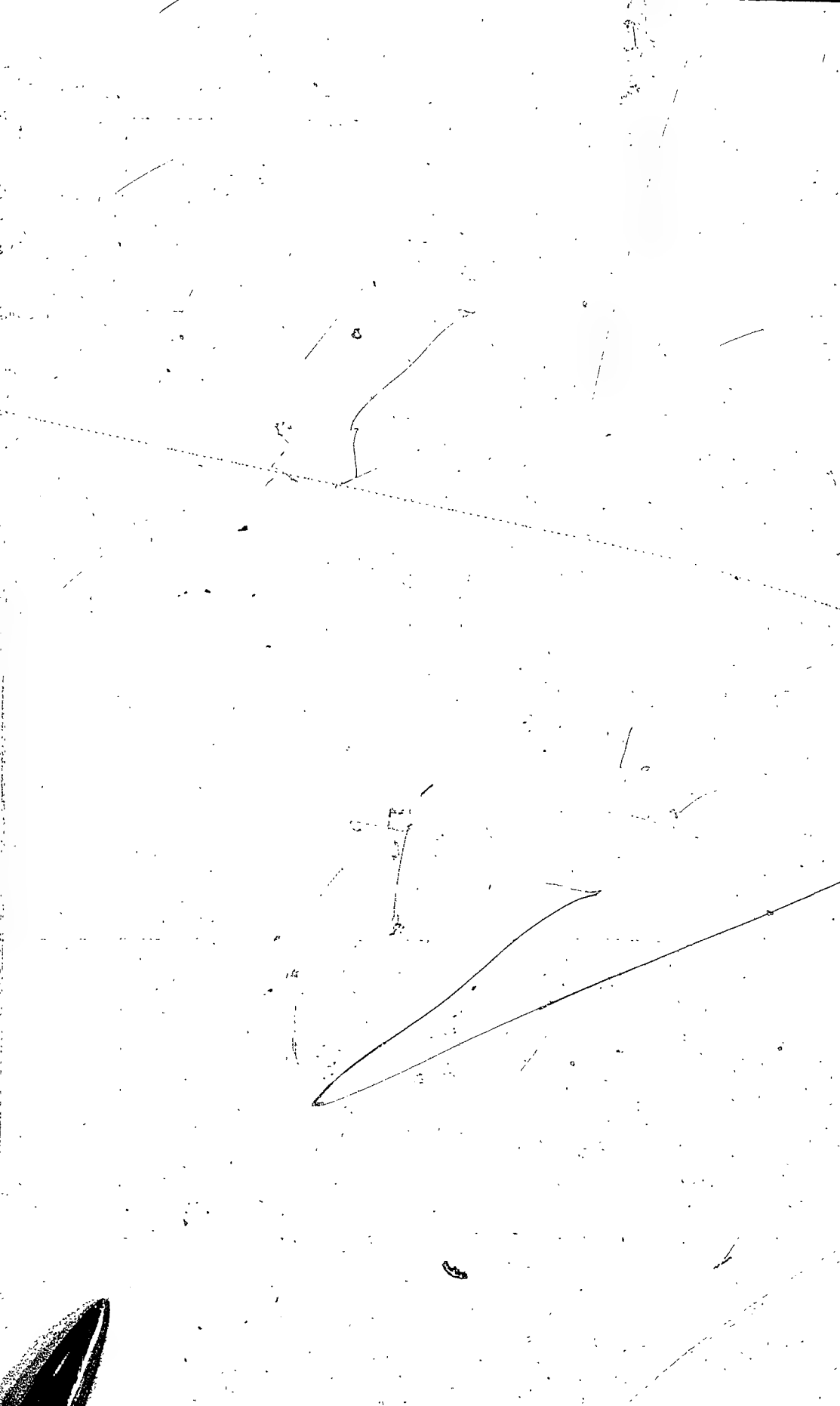
At sixty-two miles down from Deer Lake we came to the open mossy plain which extends northward to the well wooded banks of the Great Churchill.



From photo. by Mrs. J. D. Moodie.
THE BARRACKS—R.N.W.M. POLICE—CHURCHILL.



From photo. by Mrs. J. D. Moodie.
RUINS OF FORT PRINCE OF WALES—CHURCHILL.



'The distance from the mouth of the Deer River to the Hudson Bay Co's post called New Fort Churchill is twenty-two miles in a northerly direction. This part of the Great Churchill is two miles wide with a swift current to Mosquito Point. Here the river narrows to one mile, forming a short swift rapid running into the shallow tidal lagoon at seven miles from the mouth of the river.....

'There appear to be no great difficulties in securing a good line for the construction of a railway along the route followed between Split Lake and Fort Churchill. The only part which might prove difficult lies between the lower part of the Little Churchill and the headwaters of the Deer River. Here morainic clay and sand hills rise from 50 to 300 feet, with many lakes, swamps and gullies between.'

THE CHURCHILL RIVER AND ITS WATERSHED.

On their way to the Churchill in 1879, Dr. Bell and party ascended a creek on the north side of Split Lake to Assean Lake. Then they proceeded to Waskauiwaka Lake at the head of the Little Churchill. The country about Split Lake is described as slightly undulating. The shore line is unusually rock-bound, but in ascending there is found to spread over the country 'a deposit of brownish clay which appears to afford a good soil.' On the 24th of July the temperature of the water of the lake was 69°, and on the 11th September, 59° Fah. The elevation is some 440 feet above the sea. More brownish clay was gone over in making a portage of a mile from the creek on the north side of Split Lake to Assean Lake. From there to the lake at the head of the Little Churchill, 'the country traversed consists of brownish grey clay which presents steep banks on some of the lakes.....Where the ground is level it is covered with wet sphagnum.' The eastern division of Lake Waskauiwaka 'runs nearly north and has a length of about twelve miles.....The water is clear and on the 26th July it had a temperature of 67° Fah. It abounds with fish, including grey trout, some of which are very large, whitefish, pike, pickerel, dogfish and suckers.....Its elevation above the sea appears to be 936 feet. The country around is green, the timber consisting of spruce, white birch, aspen, balsam-poplar and tamarac.'

The general course of the Little Churchill River, all the way from the southern extremity of Waskauiwaka Lake to its junction with the Great Churchill, is nearly north-east, and the distance between the points about ninety miles in a straight line. For three miles below the outlet the river has a tranquil course, and then expands into a small lake, but below this, for some seventeen miles, it is broken, here and there, by rapids, past some of which short portages require to be made. Solid gneiss rock occurs at the rapids, but elsewhere the banks consist of clay, covered in some places with peat four feet thick. At thirty-eight miles from the southern extremity of Waskauiwaka Lake the Switching River falls in from the left side, and at five miles further Dr. Bell's party entered the Recluse Lakes, which are of small size and connected by a short sluggish portion of the river. 'So far,' they found 'the woods along the river generally green, but below these lakes the timber' was 'mostly burnt all the way to the Great Churchill.'

The Recluse Lakes lie close to the projected line of railway to the bay. Dr. Bell described them, as being in the north-eastern part of a valley four miles wide, excavated in the great clay deposit which is everywhere spread over this region.

Leaving the lakes a few rapids are passed on the Little Churchill, which then 'for a long distance flows in a crooked channel of uniform breadth with a tolerably swift current, between banks of clay varying from twenty to one hundred and fifty feet in height, but averaging from forty to fifty feet. The upper part of this deposit appears to be a modified clay, with occasional layers of gravel, and sometimes a ridge of gravel and sand above it; while the lower part is unstratified and full of pebbles, with some boulders. In approaching the Great Churchill, the river for a number of miles is deep and smooth and the clay banks have retired to a considerable distance

on both sides. The water of this stream has a brownish tinge and forms a striking contrast with that of the great river into which it falls. The latter is bright and clear, like the St. Lawrence water, and on the 3rd of August it had a temperature of 62° Fah. During the few days preceding this date the temperature of the Little Churchill averaged 63° Fah. Just below the junction or 'forks' the river is nearly a mile wide, and the land on the east side rises from 300 to 450 feet above its level. No rock appears in these high banks, which are evidently composed of drift. Immediately above the forks the river is much narrower, and the clay banks on both sides rise steeply to a height of about 150 feet.

Following the stream of the Great Churchill from the junction, numerous rapids are met. The banks are high, the width of the river about three-quarters of a mile and the rise 'at the rate of about seven and a half feet per mile.' According to Dr. Bell's survey, 'the distance from the junction of the Little Churchill to the mouth of the river..... is about 105 miles in a straight line, and the bearing about N. 33° E. (ast.). A considerable stream enters from the left side at twenty miles below the Little Churchill; but, with this exception, the tributaries are apparently all small. For the first twenty-five miles in a straight course below the point just mentioned, the river bends about a good deal, but from thence it makes only two (nearly straight) reaches to the sea. From the forks to the end of the first of these the average width of the river is about half a mile, and a few islands occur, but in the last reach islands are numerous, and the width of the river for a considerable distance is upwards of two miles. Beginning at thirty miles from the mouth and extending downward for ten miles, the river spreads out among a great number of islands, and below this, as far as the tidal lagoon, it is broad, shallow and much interrupted with gravelly and bouldery rapids, the last of which is opposite to Mosquito Point between seven and eight miles from the mouth. The flat-lying limestones..... do not extend to the sea-coast on the Churchill..... Westward of the lagoon, and on both sides of the mouth of the river, a different formation makes its appearance,..... massive dark grey quartzite. Peat of fair quality, and perhaps of sufficient thickness to be of economic value, was noticed in several places along the route from Split Lake to Fort Churchill. The following localities may be mentioned:—Creek north of Hudson Bay Company's post, Split Lake; outlet of Assean Lake; southern part of Waskaiowaka Lake, both sides; lagoons twelve miles south of Recluse Lakes, four feet thick on top of bank; Churchill River, twenty-one miles below the forks, five feet thick on top of bank. For some distance above and below the commencement of the last stretch, the woods occur only in patches in an open peaty country as far as can be seen along the river. Among the islands further down, bouldery and grassy spaces extend between those which are left dry in low water. For a distance of eighteen miles before reaching the mouth of the river, open grassy flats extend for a considerable but irregular breadth on either side. This open country is said to resemble the barren grounds which begin to the northwestward of Fort Churchill.... Below the junction of the Little Churchill the banks are entirely denuded of timber, and have an even and uniform slope up to a height of twenty or thirty and sometimes even forty feet above the summer level of the river. The ice would appear to extend annually to the valleys of the tributary streams, preventing the growth of timber along their sides for a considerable distance back from the main river. During the summer, however, a luxuriant growth of grass and other plants springs up and covers these sloping banks in most places with a rich green. Further down, after the river has expanded among the islands and the banks have become lower, the effects of the spring ice are no longer noticeable.....'

In 1894 Mr. J. B. Tyrnell made a survey across the country from Fort Churchill to Split Lake.

From his map and description, it is evident that the country from Fort Churchill to the headwaters of Owl River is an open or thinly wooded swampy plain sloping gently eastward towards Hudson Bay, while farther south it is undulating or hilly, and rather thickly wooded with white and black spruce and birch. A chain of small

lakes in this more hilly region had long been famous among the Indians for their excellent fisheries.

His route is shown on the accompanying map.

MR. THIBAudeau's REPORT.

The most recent report on the country to be traversed by the proposed railway is that of Mr. Thibaudeau, C.E. The line he followed is somewhat different from that shown on the map herewith. Starting from Churchill he ran in a straight line to near the Deer River, which he crossed, running his line between it and the Churchill instead of skirting it to the east as does the line on the map. This necessitated a second crossing of the Deer at upwards of one hundred miles from Churchill. Thence by a straight course he brought his line to the bend of the Little Churchill, which is touched by the line on the map at the point marked 450 miles from the Pas. From this point he followed practically the course of the map line, but so deflected as to skirt the small Lake Omatouwi and come close to Lake Assean. He skirted the first bend in the Burntwood River below Split Lake, but crossed the river at about the same point as the map line. He followed the same line along Pipe Lake, but came closer to Setting Lake, passing considerably to the south-east instead of skirting Lake Wekusko on the north-west side, and continued in a pretty direct line to the Pas—along the south-east of Lakes Cormorant and Atikomeg. He puts the length of his line at 474 miles.

For four miles from Churchill his line runs through an open country, with a soil 'clay and rock till about eight feet above high water.' Further on there is to the east 'a sandstone ridge forty feet high extending towards the bay.' For twenty-eight miles further 'the country is covered with scrub timber and tamarac,' and has 'small shore ridges.....frozen and covered with moss.' At his crossing of the Deer River it is three hundred and fifty feet wide with banks twenty-five feet high. Then follows 'a level open plain' to his hundred mile post with 'some timber along the Deer and Churchill Rivers.' For thirty miles more he went through 'scrub spruce and tamarac from 4 to 6 inches in diameter,' and 'a few lakes, swamps and ridges.' On the seventy miles following, chiefly along the east side of the Little Churchill, 'there is some timber from 6 to 14 inches in diameter' and 'the country is dry and more or less rolling.' Two hundred miles from the bay he crossed the Little Churchill. From there to Washkaïowaka Lake 'is fairly level and dry with some scrub timber.'

The lake, he estimated, is about sixteen miles in length, with two extensions connected by narrows. Clayey hills, from thirty to forty feet in height were seen on the northern shore. The banks are steep and covered with 'very thick mossy peat.' The timber 'consists of black spruce and white birch from 5 to 16 inches in diameter.' Forty miles further on, the ridge seen some forty-five miles back was crossed. It is two hundred feet high and 'is timbered with spruce 4 to 10 inches in diameter.'

Ten miles brought him to Split Lake through a country 'generally low and swampy.' Three lakes were crossed whose shores were 'well wooded with spruce, tamarac and birch.' To Grass River, thirty miles, the country on the east side is undulating and 'part of the banks and islands are fairly timbered with spruce.'

Then comes some fifteen miles of country 'more or less swampy,' with no timber of commercial value. After another fifteen miles Burntwood River is reached at a point where it is about four hundred and fifty feet wide, and its banks, which show granite, are twenty feet high. The country is 'hilly, with swamps and scrub timber.'

From this point Mr. Thibaudeau explored the country across Grass River and Landing Lake, along Sipiwek Lake and over Cross Lake to the Hudson Bay Company's post on the east side. The country is swampy in places and is covered with scrub timber with here and there 'a few bunches of good timber.' Part of the shore of Landing Lake and the islands therein 'are well timbered.' From there to the

head of Sipiwesk Lake the country is 'dry and well timbered with spruce from 8 to 14 inches in diameter.' About half way was met a ridge some eighty feet high. 'The islands of Sipiwesk Lake are well timbered with spruce—some being 30 inches in diameter.' From this lake to Cross Lake, twelve miles, 'the country travelled through is hilly, dry and covered with scrub timber.' From the company's post 'no timber of commercial value was seen on the islands.' Towards Duck Lake 'the islands or portages were covered with scattered spruce trees.' Thence to Setting Lake 'the country is nice and dry and is covered with spruce 4 to 6 inches in diameter, and aspen.' There are 'ridges fifteen to twenty feet high running parallel in a N.E.S.W. direction.' For twenty miles along the west shore of the lakes and by Grass River 'the country is good, dry and undulating,' and continues for another twenty 'dry, level and covered with scrub timber.' Then comes twenty miles, during which Grass River is crossed: 'This section is rough and is covered with hills and ridges, some one hundred and fifty feet high, running in a N.E. and S.W. direction. No timber of any commercial value was seen.' The country on to Reed Lake, some thirty-eight miles, continues rough and hilly, but 'the islands are well timbered with spruce 6 to 14 inches in diameter.' Then there is a stretch of about twenty miles of level country, half of it swamp with 'some spruce and tamarac 4 to 8 inches in diameter.' On the north side of Cormorant Lake, Mr. Thibaudeau found a strip of good timber four miles wide by ten miles long. From the lake to the Pas 'the country is undulated, without any timber of commercial value.'

Mr. Thibaudeau expresses the opinion that 'a good railway can be built at reasonable cost almost anywhere close to' the line he followed. His report will be found in *extenso* as an appendix to this paper.

CONSTABLE SELLER'S ACCOUNT.

During last January and February Constable Seller, of the R.N.W.M. Police, made a trip from Churchill to Winnipeg. He followed the left bank of the river for some twenty-five miles, then crossed to the mouth of the Deer; and after following that river a short distance took a south-west course, striking a large lake near the source of the Deer. Thence he went west to the Churchill River, following it for some five miles to the mouth of the Little Churchill, along which stream he proceeded for about seventy miles. Then he crossed in a southerly direction the lakes which are the source of the Little Churchill. From Split Lake to Cross Lake he followed the Nelson River some twenty miles; thence he made for Grass River, along which he travelled for nearly sixty miles, portaging to Landing Lake and then to Sipiwesk Lake, following the latter for fifteen miles, and then portaging to Cross Lake, which was followed to the Company's post. Thence Constable Seller travelled along the east branch of the Nelson River to Norway House, and from there across Green Lake and via Lake Winnipeg and the Grand Rapids to Mafeking, Manitoba, on the line of the Prince Albert branch of the Canadian Northern Railway, some sixty miles east of Etimami, the point from which the branch starts to the Pas.

During the whole trip the constable reports 'splendid weather.' From his records of thermometer readings it appears to have been about zero on 2nd January, the day he left barracks at Churchill. On the 5th it was 25° below and on the 7th it was 10° above. The lowest record is for the 17th, 'from 55° to 60°.' But the 9th February is noted as warm. The depth of snow for the first two hundred miles was 'hardly eighteen inches'; but thence to Norway House 'it was very deep.'

As far as Constable Seller could judge, 'the timber between Churchill and Split Lake... is not of any commercial value,' for 'it is scattered, and although thick at the butt, does not attain any great length.' But 'logs, &c., for building small houses can be procured almost at any place.' About six miles northeast of Split Lake the first hardwood—very small white birch—was seen. Between Split Lake and Norway House there is better spruce timber, with some fair sized beech, birch, pine, cedar

and ash. Between Norway House and Mafeking, especially outside Grand Rapids, some very heavy timber was seen, but there is not much hardwood in the locality.

A RECAPITULATION.

It would seem that, after the Saskatchewan is spanned at the Pas, the construction of a line of railway to Churchill would not be unusually difficult or expensive. And from the reports it would appear that there are in the intervening country stretches of fair timber, and waters replete with fish; that in a part of it wheat has been grown, and that vegetables commonly thrive.

THE BAY AND ITS COAST COUNTRY.

THE BAY.

The Hudson Bay is commonly associated with the polar regions; yet no part of it comes within the Arctic circle. Its northern part is in about the same latitude as the Highlands of Scotland, and Moose Factory, on the southern shore, is farther south than London. The temperature of the water of the bay is several degrees higher than that of Lake Superior. In the opinion of Commander Gordon the bay may be regarded as a vast basin of comparatively warm water, which doubtless has a mitigating influence on the winter of the surrounding country.

The length of the bay is a thousand miles; its greatest width is six hundred. It covers an area of over half a million miles. Its extent is six times that of the Great Lakes separating Canada from the United States. It is more than half the size of the Mediterranean, and comes within a hundred thousand miles of being equal in expansion to the Caribbean Sea.

It is the third largest marine area in the world, and is the central reservoir of the drainage of North America, extending to the centre of the Labrador peninsula, or some five hundred miles inland on the east side, and to the Rocky Mountains, or a distance of thirteen hundred miles, on the west. The Winnipeg basin constitutes a sort of outlier of the region more immediately under notice, since the waters drain into it from the north, south, east and west, and discharge themselves by one great trunk, the Nelson River, into Hudson Bay. The southernmost part of this basin, namely, the source of the Red River, extends down nearly to latitude 45°. The head waters of the southern rivers of James Bay are not far to the north of Lake Huron, while one of the branches of the Albany rises within twenty-five miles of the north shore of Lake Superior. Including the Winnipeg system, the basin of Hudson Bay has a width of upwards of two thousand miles from east to west, and a length of about fifteen hundred miles from north to south, and its dimensions approach the enormous area of three million square miles.

THE TRIBUTARY RIVERS.

Rivers flow from all sides into the bay, some thirty of them being of considerable size. Dr. Bell thus describes them: 'All those which enter on the Eastmain coast appear to flow in a uniform course directly west, or parallel to one another, and as the height of land in the centre of the Labrador peninsula is furthest inland towards the south the rivers which fall into the southern part of this coast are the largest, and the remainder become progressively smaller as we go north. Numerous streams converge to the head of James Bay from all points southward of an east and west line passing through its southern extremity. The Moose, about a mile wide, is the principal of these. On the western side the Albany and the Churchill rivers are the longest, but the Nelson, with a course of only about 400 miles, discharges the greatest

body of water into the sea. Indeed, this huge artery of the Winnipeg system of waters may be considered as one of the greatest rivers of the world. Few of the rivers of Hudson Bay afford uninterrupted navigation for large vessels to any great distance from the coast. During the season of high water shallow-draft steamers might ascend the Moose and two of its branches for upwards of a hundred miles. The Hayes River and two of its branches might also apparently be navigated by such craft in the spring to points about one hundred and forty miles inland, and the Albany for nearly two hundred and fifty miles; while the larger steamers might ascend the Nelson for seventy or eighty miles from the open sea. The Nelson is the only muddy-water river entering Hudson Bay. Most of the others have a slightly brownish tinge, but their waters are perfectly wholesome, and contain only very small quantities of foreign matter. The Churchill, which is the second largest river of Hudson Bay, is a beautiful clear-water stream, somewhat larger than the Rhine.

'The only harbours on the west side of Hudson Bay are those formed by the mouths of rivers, but none of them, with the exception of Churchill, can be entered by vessels drawing more than ten or eleven feet, and only at high water even by these. The Nelson may form an exception to this. Most of its estuary becomes dry at low tide, but a channel runs through it near the centre, as far as the head of tide-water.'

THE COAST COUNTRY.

In 'An Account of Six Years' Residence on Hudson Bay,' published in 1752, Joseph Robson stated as "an indisputable fact" that those of the company's employees who had remained their full term, would, in so far as the natural conditions were concerned, 'rather go back than enjoy the same advantages in their native country.' 'I myself,' he wrote, 'am an instance of this; and I have heard the captains frequently attest the same of others.' What he said of Churchill will be given later on.

Of York Fort he wrote: 'I have seen a small pea growing without any culture. Most kinds of garden stuff, particularly pease and beans, grow here to perfection. . . . I am of opinion that barley would flourish. . . . Gooseberries and red and black currants are found in the woods growing upon such bushes as in England.'

Camping at Hayes River, he noted: 'I should expect by no more labour than would be proper for my health to procure a desirable livelihood; not at all doubting of my being able to raise pease and beans, barley and probably other kinds of grain.'

He observed that draining of the lowland and its cultivation resulted in less frost and early thawing, and testified that 'the natural produce of Hudson Bay grows very fast, and comes to perfection much sooner than that of England. There is no spring and fall—a leap from winter to summer.'

So convinced was he of the richness of the resources of the country about the bay, that he urged as a most beneficial measure even at that early date the purchase by the Imperial government of the 'right the company pretend to have to the bay and all the countries round it.' He considered that it afforded 'an extensive field of trade.' 'The soil,' he wrote, 'is fertile, the climate temperate, fit for the produce of all kinds of grain and for raising flocks of tame cattle, . . . there are also many valuable mines and minerals.'

He thus summed up his personal experience and the information afforded by the report of the British parliamentary inquiry: 'That the countries about the bay are capable of great improvements; that the land southward and westward of the bay are in good climates equal in their several latitudes to those in Asia and Europe, and that the climate improves farther inland. . . . that at Churchill horses and cows have been kept in winter, though greatly exposed to the frost and cold; that all sorts of garden stuff flourish at the factories, and where barley and oats have been sown they come to perfection; that at Moose Factory sown wheat has stood the winter frosts and

grown very well the summer following. . . . that black cherries also planted here have grown and borne fruit, as would other trees if propagated. . . . that the climate is not worse than that of Sweden, Denmark, Russia, Poland and North Germany.'

According to Mr. Frost, who was employed for many years at Churchill and Moose Factory, 'upon the southern branch (of the Moose) all sorts of grain thrives, as barley, beans and peas do at the Factory, though exposed to all the chilling winds that come from the ice in the bay. Upon the southern bank along the falls there grows naturally along the river wild oats or rice . . . the husk being black, but the grain within perfectly white and clear like rice, the Indians beating it off from their canoes, when ripe, as they pass along the river, it growing in the water like rice.

. . . In their woods at the bottom of the bay at Moose and Albany, as well as at Rupert's River, are very large timber trees of all kinds, oak, ash, &c., as well as pine, cedar and spruce; they have exceedingly good grass to make hay . . . and may have everywhere within land all sorts of pulse and grain, and all sorts of fruit trees as in the same climates in Europe; for what sorts they have tried thrive very well.'

Writing in 1744, Arthur Dobbs, who made an exhaustive study of all the then available data respecting the bay and surrounding country, thus summed up his impressions: 'There might be comfortable settlements made in most places, and very tolerable even in the worst and coldest parts of that continent, which are the north-east and northwest sides of the bay; but on the southern and western sides of the bay there might be made as comfortable settlements as in Sweden, Livonia, or on the south side of the Baltic; and farther into the country southwest the climate is as good as the southern part of Poland and northern part of Germany and Holland.'

A century and a half later, Mr. P. T. McGrath, of Newfoundland, foresees the day when 'the shores of the bay will be peopled with prosperous communities and its waters dotted with the argosies of commerce.'

THE RESOURCES OF THE BAY AND ITS COAST.

In his report of 1879-80, which is replete with detailed information, Dr. Bell writes: 'The resources of Hudson Bay and the country immediately around it are various and numerous, although as yet few of them are at all developed. The fur trade is the principal and best known business which has hitherto been carried on in these regions; but a considerable amount of oil, derived from the larger whales, the porpoises, walrus, white bears and various species of seals which frequent the northern parts of the bay, has been carried to New England, and small quantities, principally of porpoise and seal oil, have, from time to time, been taken to London by the Hudson Bay Company. Other articles have been exported from the bay but hitherto only in trifling quantities. They embrace whalebone, feathers, quills, castor, lead, ore, lumber, ivory, tallow, isinglass, and skins of seals and porpoises. Both the Indian and Eskimo find a variety of fish for their own use, and fine salmon abound in the rivers of Hudson Strait. From one or two of them a considerable number of barrels, in a salted condition, are exported every year by the Hudson Bay Company. Water fowl are very numerous on both sides of the bay, and larger game on the barren grounds in northern parts.

'But perhaps the most important of the undeveloped resources of the country around the bay are its soil, timber and minerals. To the south and the southwest of James Bay, in the latitude of Devonshire and Cornwall, there is a large tract in which much of the land is good, and the climate sufficiently favourable for the successful prosecution of stock and dairy farming. A strip of country along the east side of James Bay may also prove available for these purposes. To the southwest of the wide part of the bay the country is well wooded, and although little or no rock comes to the surface over an immense area, still neither the soil nor the climate is suitable for

carrying on agriculture as a principal occupation until we have passed over more than half the distance to Lake Winnipeg. This region, however, appears to offer no engineering difficulties to the construction of a railway from the sea-coast to the better country beyond, and this, at present, is the most important point in regard to it. Some of the timber found in the country which sends its waters into James Bay may prove to be of value for export. Among the kinds which it produces may be mentioned white, red and pitch pine, black and white spruce, balsam, larch, white cedar and white birch. The numerous rivers which converge towards the head of James Bay offer facilities for 'driving' timber to points at which it may be shipped by sea-going vessels.

'Minerals may, however, become in future the greatest of the resources of the shores of Hudson Bay. Little direct search has as yet been made for the valuable minerals of these regions. In 1875, a large deposit of rich ironstone was found on the Mattagami River. In 1877 inexhaustible supplies of good manganiferous iron ore were discovered on the islands near the Eastmain coast, and promising quantities of galena around Richmond Gulf and also near Little Whale River, where a small amount had previously been known to exist. Traces of gold, silver, molybdenum, and copper were likewise noted on the Eastmain coast. Lignite was met with on the Missinaibi, gypsum on the Moose and petroleum-bearing limestone on the Abitibi River. Small quantities of anthracite and various ornamental stones, and some rare minerals, were collected in the course of explorations around the bay. Soapstone is abundant not far from Mosquito Bay on the east side, and iron pyrites between Churchill and Marble Island on the west. Good building stones, clays and limestones exist on both sides of the bay. A cargo of mica is said to have been taken from Chesterfield inlet to New York, and valuable deposits of plumbago are reported to occur on the north side of Hudson Strait.'

It is reported that between Cape Jones and Cape Dufferin, a distance of some two hundred miles, good iron ore was found in 'inexhaustible quantities,' that the islands along that coast are mostly capped with iron. It is said to be 'principally manganiferous carbonate of iron, valuable for the manufacture of Bessemer steel' and 'better than English ore.'

Commander Gordon's statement as to the resources of Hudson Bay is in effect that the economic fish and mammals are the whale, porpoise, walrus, narwhal, seal, salmon, trout, cod, and a variety of small fish; and that the only fishing industries developed are the whale fishery by the Americans, and the porpoise, walrus, salmon and trout fisheries by the Hudson's Bay Company. The porpoise fishery was the most extensive. The blubber of these mammals weighs from 250 to 400 pounds, and is very rich in the finest of oils. The year before, Commander Gordon wrote, the Company captured some two hundred in one tide at Churchill, and much larger numbers at Ungava Bay. Instead of exporting the blubber in bulk the company established refineries at several northern stations, and shipped the refined oil to Europe. There are 'two very productive walrus grounds north of Marble Island, where the company,' Commander Gordon tells us, 'never fail to get,' in a few weeks, 'as much blubber, ivory and hides as their vessels will carry.' He found that the company is engaged at several points, particularly at Ungava, in fishing salmon and trout which abound in nearly all the streams. At the time of his expedition the company had a steamer running from London to Ungava Bay direct, fitted out with refrigerating apparatus, by means of which they were enabled to send home the salmon fresh to the London market, where it realized high and profitable prices.

Mr. Low, in his 'Cruise of the Neptune,' writes:

'The fur trade with the Indians and Eskimos living about Hudson Bay or along interior routes tributary to it, has, for a period extending over two centuries and a half, furnished cargoes for two or more ships belonging to the Hudson's Bay Company. At the present time two ships are engaged in this trade for the company, while Revillon Frères employ two more. The whale fishery now supports two ships. These four ships represent the developed trade of the bay and strait at the present time.'

'The undeveloped natural resources of the regions surrounding these waters appertain to mining and fisheries, and to the forestry of the territory surrounding the rivers flowing into the southern parts of the bay. Iron ores have been found on the islands and shores of the eastern side of Hudson Bay, where they cover large areas and where valuable deposits corresponding to those of the hard ores of Lake Superior will be discovered when sought for. On the western shores of the bay between Chesterfield inlet and Churchill extensive deposits of copper-bearing rocks have been located, and there is every prospect of valuable mines being discovered in that region when the ground has been properly prospected. A valuable mica mine is being worked at a profit on the north shore of Hudson Strait, and the condition and character of the rocks there point to the discovery of similar deposits on that side of the strait. Iron ores are known to occur along the west side of Ungava Bay and the rocks of the southern side of the strait in many places are favourable to the occurrence of valuable minerals. The greater part of the coastal region has only been geologically examined in a hurried manner, while large stretches are practically unknown inland.

'Nothing is at present known of the fisheries of the deeper waters of the strait and bay, and the knowledge of the fisheries of these waters is confined to the coasts and rivers. In the southern part of the bay, large quantities of sea-run trout and whitefish are taken by the natives. The Arctic salmon, a fish superior to the best Pacific salmon, is plentiful along the eastern side of the bay to the northward of James Bay, as well as in the mouths of the rivers of the northern and northwest coasts, and also along both shores of the strait. Lake trout is a common fish in these northern rivers and lakes. Cod have been taken in several places along the east side of Hudson Bay as far north as Cape Smith; on the western side little is known of this fish beyond the occurrence of a few in Roe's Welcome, and some small specimens taken among the ice at Fullerton. A cod fishery has been carried on for a number of years at Cape Chidley, and these fish are said to be plentiful along the east side of Ungava Bay, but do not appear to go farther westward through the strait from the Atlantic. Cod are reported to be abundant in some of the fiords of the south side of the Frobisher Bay. . . . Large areas of pulpwood and merchantable spruce occur along the banks of the streams, awaiting a suitable outlet to market by way of Hudson Bay and Strait.'

A SUMMARY.

The country about the bay has only been glanced at by explorers. Scarcely any real prospecting has been done. Yet there is good evidence of immense deposits of manganiferous iron; there are important showings of copper and other minerals; and there are traces of coal. Merchantable timber has been seen and vast stretches of pulpwood. And there is the wealth of the waters, only touched as yet, but giving in the little that has been done the promise of great possibilities.

CHURCHILL HARBOUR.

A DESCRIPTION.

(From Report of J. B. Tyrrell.)

At a point on the west side the Churchill River gives its waters to the bay. Its mouth is narrow, not more than half a mile wide. It extends for two miles between walls of solid rock, into a lagoon about two miles wide at high water, and one mile at low. Tidewater meets the river as it leaps the east rapid seven miles from its mouth.

'In 1773, the Hudson Bay Company began building the massive stone fortification, which they called Fort Prince of Wales, on the summit of the low point west of the entrance to Churchill harbour. For several years, between 1733 and 1747, Joseph

Robson, an engineer, was stationed at Churchill to superintend its erection. About 1746, he made a survey of the harbour and river for ten miles up from its mouth and drafted a map which he published in 1752. This map shows the river at high and low water, with rocks and low marshy ground around it, just about as it is at present. A narrow neck of land, above high-water mark, connects the point on which Fort Prince of Wales is built with the main shore, the rocky portion of which neck is still very little above high-water mark. The low-water mark is a quarter of a mile out from the mouth of Sloop's Cove, two miles above the old Fort, and stony flats extend for a mile between high and low water opposite the position of the present trading-post of the Hudson Bay Company. The high-water mark was much the same then as now, and marshy ground but a few feet above the water, well shown on the old map, still extends southwest from the lagoon. A rise or fall of the land of a very few feet would change the shore-line considerably, and this old map shows clearly that no great change in the elevation of the land has taken place since it was made over a century and a half ago. The fort is surrounded by a gravel-covered plain or terrace, and the base of its wall is now seventeen feet above ordinary spring tide, and the top of the shingle beach, which is now regularly washed by the storm waves at ordinary spring tides, is only six feet below the base of the walls. If the land had been eight or ten feet lower in 1733 than it is at present, the storm waves with high spring tides would have regularly washed over the point, and it is not likely that a structure of any kind would have been built there, for the place would have been a disagreeable and dangerous one.

The trading store and mission at Churchill are situated on the west side of the tidal lagoon at the mouth of the Churchill River, on an old sandy beach a few feet above high-tide level. At ebb-tide there is exposed in front of the post a mud flat nearly a mile wide. Back of the beach, which is between one hundred and two hundred yards in width, steep, bare, rounded hills rise to a height of eighty to one hundred feet, forming part of the rocky ridge which extends along the west side of the river for several miles out to the extreme end of Eskimo Point at the old fort, forming the bold promontory between the river and the east side of Button Bay. A similar rocky ridge forms the east side of the tidal lagoon, and thence extends eastward for a number of miles along the shore of the bay towards Cape Churchill. At a mile and a half up from Battery Point, the Hudson Bay Company have a whaling station which is situated at the foot of the rocky ridge. 'From this point,' writes Mr. O'Sullivan, 'old beaches made up of clay, sand and gravel are seen at different levels running in a southeasterly direction, the highest attaining an elevation of fifty feet above the river.'

THE HARBOURAGE.

The mouth of the Churchill forms the most southern harbour on the west coast for ships drawing over twenty-four feet of water. The channel of approach is fairly deep and wide. The tide is pretty uniform, rising at its maximum, on an average, eleven or twelve feet. At all its stages the harbour can be reached. Mr. Thibaudeau, C.E., made extensive soundings last fall. He reports the depth at low water at the entrance of the harbour to be from eight to twelve fathoms. Half a mile within, the minimum depth is seven fathoms. At the head of the harbour there are two shoals over which at low tide there is from two and a quarter to two and a half fathoms of water, and between and around them the depth is from four to four and one-half fathoms. With modern aids to navigation along the approach, and docks and elevators in the harbour, Churchill would afford all the port requirements necessary for connecting the railway with the waterway afforded by the bay and straits.

WHEN OPEN.

A record kept for seventy years by the Hudson's Bay Company officials at Churchill shows that the harbour was open on an average for five months—from the

19th June to the 18th November. The longest open season was five months and eighteen days. That was in 1846. The shortest—four months and eight days—was in 1838. The earliest date at which the harbour opened was the 5th June, 1863, and the latest the 2nd July, 1866. The earliest on which it closed was the 1st November, 1837, and the latest the 4th December, 1861 and 1885.

RESOURCES OF VICINITY.

From personal knowledge of Fort Churchill, and the country for nine miles up the river, Joseph Robson wrote in 1752: 'The marshes and low ground are full of good grass; and there is a patch of ground near Eskimaux Point which, though exposed to the north and northeast, produces good radishes, coleworts, turnips, small carrots and lettuces, and other salading; blackberries also grow upon the heath. . . . The cattle here would live and do well if the same care was taken of them as is generally taken in England. The horses . . . had been kept for several years and were constantly employed in drawing stone and other material for the fort.'

Dr. Bell saw some very good potatoes and turnips growing at Churchill. He observed an abundance of hay in the neighbourhood, and near the bay open grassy land of unlimited extent, much of which is dry and affords extensive pasturage. He found that the small herd of cattle were in 1879-80 being recruited by animals calved at the fort, whereas formerly it was not considered possible to breed stock there.

Four miles from Churchill, Mr. Thibaudeau, C.E., in running his line passed through an open country with a clayey as well as a rocky soil.

According to Mr. O'Sullivan, wood is scarce at Churchill, the Hudson Bay Company having to obtain their supply of fuel from a ravine three miles distant, where there is black spruce, averaging five inches in diameter. But Churchill will have no difficulty in getting a fuel supply of coal. And Dr. Bell found spruce and tamarac growing near the sea coast in favourable situations as far as Seal River. The spruce, although not growing as a continuous forest quite as far north as Fort Churchill, being in that neighbourhood of sufficient size for building purposes.

Salmon, sea trout and whitefish are, Mr. O'Sullivan states, 'both plentiful and of excellent quality,' and 'the porpoise or white whale is very common in the mouth of the Churchill.' The barren ground caribou herd in hundreds over the country, and wild geese, duck and ptarmigan there breed and abound.

Mr. William Beech, who returned to Winnipeg in April last from an extended prospecting trip in the vicinity of Churchill, which is described in the Engineering and Mining Journal, held out abundant hope of future mineral development. According to his account there are valuable plumbago deposits within a few miles of Churchill, and iron ore within six miles, while mica of the white and brown varieties abounds in the vicinage. He has located and registered claims and purposes returning to make further researches. He found other prospectors at work.

THE CLIMATE.

Captain Middleton reached Churchill on the 10th August, 1741, and wintered there. His records evidence no great severity of weather. The first snow fell on September 1. The geese then went southward. By October 18 it became really cold and winter weather continued; but by March 17 it grew milder, and by April 2 the record is, 'calm and warm, with a clear sky.' There was, of course, frost after that.

Mr. E. Mosher, of Halifax, was at Churchill from September 2 to January 7, superintending the construction of buildings for the R.N.W.M. Police. 'So far,' he said, 'as the weather is concerned, I would as soon have spent the months in Churchill as in Halifax.' He 'did not find the cold any more severe than in the east.' According to his observations, 'the lowest temperature registered was 39° below zero.'

THE CONCLUSION.

From all the information disclosed in the records of the period that extends from the days which Joseph Robson spent at Churchill superintending the construction of Fort Prince of Wales, over a century and a half ago, to those which Mr. Mosher spent there recently while superintending the construction of the police barracks, it would appear that Canada has at that point on Hudson Bay a safe port, open for several months in each year, and a site for a city, with immense fisheries at its doors, and large possibilities as to the development of the mineral wealth deposited in its neighbourhood.

APPENDIX A.

REPORT OF W. THIBAudeau

ON EXPLORATORY SURVEY OF COUNTRY BETWEEN FORT
CHURCHILL AND LE PAS, IN CONNECTION
WITH HUDSON BAY ROUTE.

OTTAWA, May 10, 1907.

E. DEVILLE, Esq.,
Surveyor General,
Ottawa.

SIR,—In accordance with your instructions, dated July 26, 1906, referring to an exploration of the country lying between Fort Churchill on the Hudson Bay and Le Pas on the Saskatchewan river, I beg to report as follows:—

I left Ottawa on July 27, 1906, arrived at Halifax on July 28, 1906. I sailed from Halifax to Hudson Bay on August 1, 1906, and arrived at Fort Churchill on September 2, 1906.

I was informed by the Hudson Bay people that all the Indians had left the fort a week before, and also, being short of provisions, they could not supply me with provisions for any length of time, nor with any men or dog teams. I was, therefore, compelled to endure delay as to commencing any exploration from Churchill to Le Pas until I could secure help, and outfit, necessary to the accomplishment of the trip. In the meantime, I made a detailed exploration of Churchill and surroundings and of Churchill harbour. I left Churchill for Le Pas on January 2, 1907, and arrived at Le Pas February 16, 1907.

FORT CHURCHILL HARBOUR.

This harbour can be kept open all the year by the employment of ice-breakers. Last year, 1906, the harbour closed between December 5 and 10. The conditions in January, 1907, were as follows: In the bay at Fort Churchill the ice was eleven inches thick. It extended for a third of a mile from the shore into the bay. Ice was much thinner in the bay than in the harbour. There was some floating ice about a quarter of a mile from the edge of the bay ice. This is sent in by a northerly wind; should the prevailing winds blow from any other direction, there would be no floating ice.

Beyond this floating ice there was clear open water straight away into the bay and beyond.

This was the general condition up to and including January 2, 1907. An ice-breaker similar to either the *North* or *South* now in use between Quebec and Lévis, would, by making two trips a week, keep the harbour open the year round.

The neap tide is 12 feet and the spring tide 16 feet. The average current in the harbour, with the tide running out, is six knots. This current would materially assist in keeping the channel free from ice; after it was broken by the ice-breaker, the tide would carry it out.

The Churchill river freezes about one month before the harbour, with the result that there is no discharge of heavy ice into the harbour.

The water in the Churchill river being shallow, there is consequently only a light discharge of ice under any circumstances, and its effect on the harbour is not appreciable.

The entrance to the harbour is about 2,000 feet wide, with a minimum depth of water of ten fathoms. Vessels drawing 36 feet of water could enter the harbour and anchor within 200 yards of the west shore, to a point 3,500 feet south of Fort Prince of Wales. The bay outside the harbour also affords good anchorage; there is ample depth of water.

A vessel drawing 24 feet of water can come within 150 yards of the east side of the harbour, from its mouth to a point 150 yards south of Battery beacon. There is also good anchorage south of the point east alluded to (150 yards south of Battery beacon) for 2,000 feet by 800 feet in width for vessels drawing 24 feet of water. Opposite Battery beacon for a distance of 2,500 feet across the harbour there is a minimum depth of 24 feet of water.

From the harbour entrance following the east shore, the bottom consists of sand deposited by eddies, caused by the outrunning tide. From the harbour entrance to a point 150 yards south of Battery beacon and extending into the harbour about 300 yards in width, the bottom might easily be dredged.

CHURCHILL.

Churchill consists of two peninsulas, one on the west being about ten miles by three miles wide at the southern end, and one on the east side, about five miles by two miles wide at the southern end. The western peninsula on its western side has two ridges each from 90 to 125 feet in height; the northern one extending $3\frac{1}{2}$ miles southerly from Fort Prince of Wales, and the southerly one commencing at a point $4\frac{1}{2}$ miles south of Fort Prince of Wales and extending southerly a distance of about 11 miles.

These ridges consist of (felspathic-quartzite) sandstone of a green, gray colour, well adapted for building purposes. Fort Prince of Wales is built of this stone, and its durability may be gauged by the fact that it has not suffered, although built in 1733.

On the southerly end of the northern ridge, there is a deposit of white quartzite, similar in formation to Marble Island; this stone takes a fine finish and is well adapted for ornamental building purposes; an area of about 10 acres is exposed. The northerly ridge forms a level plateau, sandy in places, the southerly end being rugged. The southerly ridge is rugged from its northern end until opposite Mosquito Point.

From the point of the west peninsula to the R.N.W.M. Police Post, the terrace is sand and gravel; the balance to Mosquito Point is clay and rocky till. Broken limestone is found in large quantities within half a mile southerly of the police post.

From Fort Churchill for $2\frac{1}{2}$ miles southerly the flat averages about one mile in width, and contains fine grazing land.

FORT PRINCE OF WALES.

Fort Prince of Wales is situated at the west side of the entrance of the harbour at Churchill. It occupies a position about 12 feet above high water mark. It is built of sandstone quarried in the vicinity. The fort was commenced in 1733 and was completed in 1747. Joseph Robson was the engineer. The length of each side is 312 feet; three of the sides are of dressed and dimension stone both inside and out. This could be utilized for building purposes. The walls are 34 feet thick and 16 feet high and were mounted by 40 cannon.

This fort was captured and partially destroyed by the French Admiral La Perouse in 1782.

R. N. W. M. P. POST.

The R. N. W. M. Police erected in 1906 a post on the beach about 6,000 feet southerly from Fort Prince of Wales. The post consists of six nice lumber buildings.

FORT CHURCHILL.

Fort Churchill was established in 1688 and rebuilt in 1721; it is situated on the beach on the west side of the Churchill river about 5 miles from its mouth, and is the headquarters of the Hudson's Bay Company. It has a missionary, Episcopal Church; the company's stores, etc., comprise about 15 buildings. Back of this beach, which is 100 to 200 yards in width, rise steep bare rounded hills to a height of 80 and 100 feet.

EASTERN PENINSULA.

Following the shore from the entrance to the harbour for 150 yards south of Battery beacon, there is a rocky ridge from 30 to 45 feet in height of the same formation as the one described on the western peninsula; the stone is also well suited for building purposes. Thence for $2\frac{1}{2}$ miles southerly the ridge takes a bend inland, the flat in some places being $\frac{1}{2}$ of a mile in width between the ridge and the shore line.

On the plateau formed by this ridge, between the Battery and Battery beacon, from the harbour to the bay, there are good building sites. About a mile south of Battery beacon, the plateau is sandy and, extending from the river to the bay, a distance of 3,000 feet in length by 1,200 feet in width, is also good for building sites. The balance of the plateau is more or less rocky and broken.

About 3 miles southerly of Battery beacon, and two-thirds of a mile from the river, are three or four fresh water lakes at an elevation of fifteen feet above high water. The bottoms of these lakes consist of limestone. They cover an area of about one square mile and would furnish good water supply.

Between the lakes and the river a good site exists for large railway shops and yards. The flats are formed of clay and rocky till.

From high water mark to a point half a mile in the river, the water is only two feet deep; this land is susceptible of reclamation. About $2\frac{1}{2}$ miles from Battery beacon, southerly on the Hudson Bay shore, there is a large deposit of limestone, of a cream colour. This covers an area of 1,200 to 1,500 feet and extends into the bay as far as low water mark, a distance of about half a mile. This is easy to quarry and would make good building stone and lime for building purposes.

Although there is no merchantable timber in the vicinity of Churchill, there is abundance of fine building stone and limestone to be found everywhere, and there is also an ample supply of timber for fuel purposes for many years along both banks of the Churchill river and around Button Bay.

In September, October and part of November large shoals of white whales (I counted 35 in one shoal) could be seen going up river at every tide. Salmon, trout and whitefish are taken in the river and harbor all the year, but are more abundant in the spring.

At Churchill potatoes, turnips and other vegetables have been successfully raised at the Hudson Bay Fort. For many years cattle and horses have been successfully kept and bred at the Hudson's Bay post; excellent butter was also made. Splendid pasture and hay meadows are found on both sides of the river above the harbour for a known distance of 35 miles.

At the head of Button Bay there is an area of 2,000 acres upon which good hay can be cut, which has been pronounced by Professor Macoun as affording excellent forage. Wild black and red currants and gooseberries are found in great quantities, and are the equal, if not the superior in flavour of garden produce. Barrels of black currants can be picked around Fort Prince of Wales. Cranberries exist in great abundance everywhere. Other berries which are indigenous to the climate abound.

GAME AND FUR BEARING ANIMALS.

Within a few miles of Fort Churchill, in the fall and winter, large herds of barren land caribou were encountered. These herds supply fresh meat of an excellent quality for the residents of Churchill. Polar bears are occasionally shot in the vicinity of Churchill. Along the western peninsula Eskimo congregate in the spring for the purpose of seal hunting, these animals frequenting these shores in the spring in large numbers.

Among the fur bearing animals are found black fox, silver fox, red and white fox, marten, and wolves both black and gray.

Swans, geese, ptarmigan and many species of duck in large numbers, and some spruce grouse are found along the shores of Churchill harbour and river.

EXPLORATION BETWEEN CHURCHILL AND NORTH RIVER.

Between October 24, 1906, and November 9, 1906, I made an exploration of the country between North river and Churchill river for a distance south of Button Bay, of about 20 miles. On the east side of Button Bay I found a strip of good timber, consisting of spruce and tamarac 6 to 10 inches in diameter, about half a mile wide and extending 3 to 4 miles in length on the east side, between the southern ridge of Churchill peninsula and the bay, and about 3 miles southerly of Fort Churchill.

At the head of Button Bay (and parallel with it), there are a number of parallel ridges extending to North river. These ridges are timbered with spruce and tamarac 4 to 10 inches in diameter. Close to the North river there is good spruce timber 10 to 30 inches in diameter in small scattered bunches, covering a distance of about 4 miles.

At the southern end of the south ridge of the western peninsula at Churchill, there is a strip of good spruce timber, 6 to 12 inches in diameter, extending about 2 miles by 4 miles; also on the east side of the same ridge about one and one-third miles south of Mosquito Point, there is a strip of good timber for a distance of about 4 miles. The balance of the country explored was level and perpetually frozen and open, covered with thick moss and small ponds, with occasional bluffs of scrubby timber.

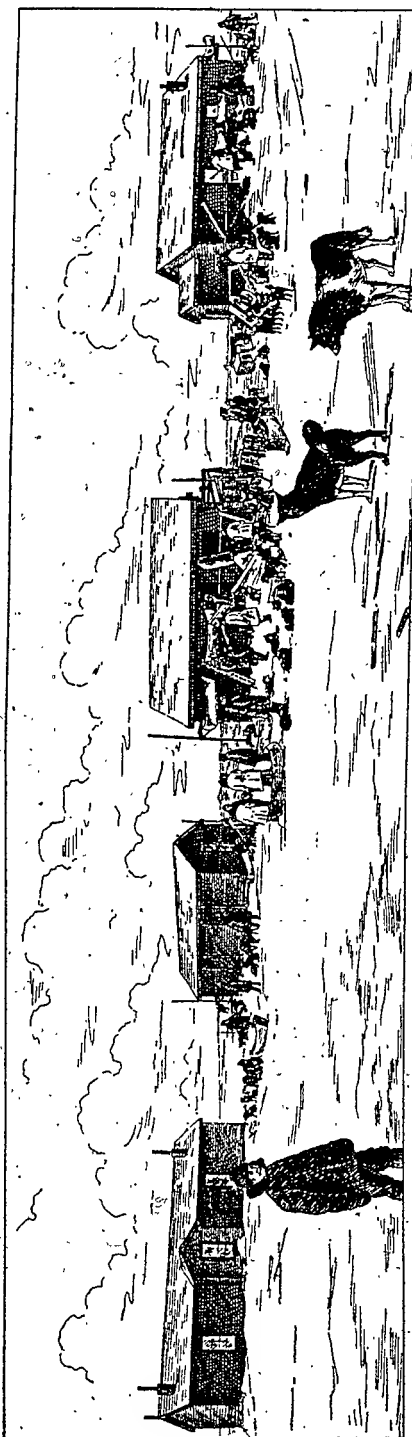
EXPLORATION TO OWL RIVER.

Between December 7, 1906, and December 17, 1906, I made an exploration of the country between Churchill and Owl river. Four miles from Churchill river in a southerly direction I crossed a ridge, running in a northeast and southwest direction at about 1½ miles from Hudson Bay, extending opposite to Mosquito Point. From the point of crossing to the bay, on the sunny side the ridge is well timbered with spruce 6 to 12 inches in diameter. Twenty-five miles from the starting point, I crossed another sandy ridge with scrubby timber. Two miles west of this point there is a barren hill known as White Mountain, 300 feet in height by 1 mile in length. At the eastern woods there are a few square miles of spruce and tamarac averaging 6 to 8 inches in diameter. Close to White Whale lake I crossed another gravel ridge, no timber. On each side of Salmon creek there are scrubs, willows and small spruce, with grassy meadows. At Broad river to the left of the place of crossing, for about 4 miles there is a strip of timber one-third of a mile in width, 8 to 14 inches in diameter, consisting of stunted black spruce.

The balance of the country is open, level plain, perpetually frozen, covered with thick moss and having many ponds. For one whole day we passed through an immense herd of barren land caribou. There must have been thousands of them.

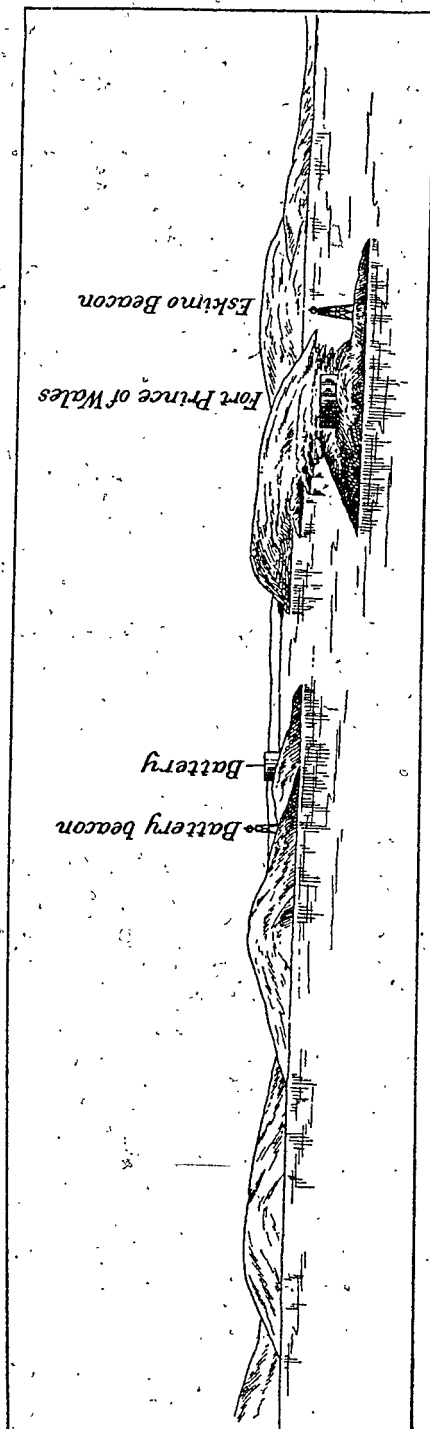
GENERAL DESCRIPTION OF THE COUNTRY ALONG THE ROUTE TRAVELLED FROM FORT CHURCHILL TO LE PAS.

From Station O, Churchill harbour, the first four miles are through open country, the soil is clay and rocky till about eight feet above high water. To the east of the



From photo. by Mrs. J. D. Moodie.

INDIAN VISITORS AT THE POLICE BARRACKS—CHRISTMAS—1906—CHURCHILL.



VIEW OF CHURCHILL HARBOUR FROM THE MAST HEAD—BATTERY BEACON, S. $\frac{1}{2}$ E. 2 $\frac{1}{2}$ MILES.
From sketch by Lieut. A. R. Gordon, R.N.

proposed route about three-quarters of a mile from high water mark, there is a sand-stone ridge about 40 feet high, extending towards the Hudson Bay for a distance of 7 miles.

From Station 4, the country is covered with scrub timber and tamarac for a distance of 28 miles. Small shore ridges averaging about 6 feet in height, are also found along this section. Those ridges are frozen and covered with moss.

At Station 52, Deer river was crossed. At that point it is 350 feet wide from bank to bank, which are 25 feet high.

From Station 32 to Station 100, the country is a level open plain. Some timber is seen along Deer and Churchill rivers.

At the end of September I dug two holes, one on each side of Deer river, twelve miles from its mouth, and at 7 feet deep found clay with rocky till. The material gone through was pit, containing about 50 per cent of ice heavily covered with moss. On this last section there are a few shallow ponds which can be easily avoided. Timber is seen along Churchill and Deer rivers.

From Station 100 to Station 130, Churchill river, the country is covered with scrub, spruce and tamarac from 4 to 6 inches in diameter. There are also a few lakes and swamps, and some ridges from 10 to 15 feet high. This last section is about 250 feet above Little Churchill river. From Station 130 we reached Churchill river, about three miles below the mouth of Little Churchill. There is no timber along this part. From that point we travelled on the east side of Little Churchill river to Station 200. Along this section there is some timber from 6 to 14 inches in diameter. The country is dry, more or less rolling, with a depression of 10 to 15 feet. At a distance from Station 200 a ridge is seen in a southwesterly direction.

At Station 200 we crossed again the Little Churchill river, thence followed its west side to Waskaiowaka lake. That section is fairly level and dry, with some scrub timber. Waskaiowaka lake is about 16 miles long, it has two extensions connected by narrows. Clayey hills, 30 to 40 feet above the lake, were seen on the northern shore of the northern part of this lake.

The banks are steep and covered with very thick mossy peat, probably 10 feet thick. The timber consists of black spruce and white birch from 5 to 16 inches in diameter. At Station 240 we crossed the same ridge seen at Station 195. This ridge is 200 feet high, and runs a few degrees south of west. It is thickly timbered with spruce 4 to 10 inches in diameter. From Station 240 to Station 250 on Split lake, Hudson Bay post, the country is generally low and swampy. Travelling over three lakes, we found their shores well wooded with spruce, tamarac and birch. From Hudson Bay Company's post to the mouth of Grass river, Station 280, the country on the east side of the lake is undulating, and part of the banks and islands are fairly timbered with spruce.

From the mouth of Grass river to Station 294 on the east side of the river, there is no timber of commercial value. The country is more or less swampy.

From Station 294 to Station 310 we reached Burntwood river, which is about 450 feet wide at that point. The banks are about 20 feet high, showing granite in some places on either side. The country is hilly, with swamps and scrub timber.

From Station 310 to 355 on Grass river, the country travelled through is very much like the last described section.

From Station 335 to Station 364, Landing lake, the country travelled through is covered with scrub timber with the exception of a few bunches of good timber here and there. Part of the shore of Landing lake and the islands are well timbered with spruce 6 to 10 inches in diameter. Travelling from Landing lake to the head of Sipiwesik lake, the country was found dry and well timbered with spruce from 8 to 14 inches in diameter. About half way on this section we crossed a ridge about 80 feet high on which we noticed Mr. Bayne's old exploration line. From Station 364 to Station 400, the islands of Sipiwesik lake are well timbered with spruce, some being 30 inches in diameter.

From Station 400 to Station 412, Nelson river, the country travelled through is hilly, dry and covered with scrub timber.

From Station 412, Hudson Bay post, on Cross lake, there was no timber of commercial value seen on the islands.

From Station 422 to 436, Duck lake, the islands or portages were covered with scattered spruce trees.

From Station 436 to Station 460, Setting lake, the country is level and dry, covered with spruce 4 to 6 inches in diameter and some ridges 15 to 20 feet high running parallel in a northeasterly and southwesterly direction. At Station 438 we crossed Mr. Bayne's old exploration line.

From Station 460 to Station 480 we followed the west shore of lakes and Grass river. The country is good, dry and undulating.

From Station 480 to Station 500 the country is dry and level, covered with scrub timber. From Station 500 to 520 we struck Grass river. The country on this section is rough, covered with hills and ridges, some 150 feet high, running in a northeasterly and southwesterly direction. No timber of any commercial value was seen around.

From Station 520 to Station 558 we followed Grass river, Wekusko lake and Reed lake. The country travelled is rough and hilly.

On Reed lake, the islands are well timbered with spruce 6 to 14 inches in diameter.

From Reed lake to Station 616 the country is level, 40 per cent being swampy. There is some spruce and tamarac timber 4 to 8 inches in diameter.

From Station 616, on the north side of Cormorant lake, there is a strip of timber, 4 miles wide by 10 miles long. This timber is the best seen while exploring around that country.

From Cormorant lake to Le Pas the country is undulating, without any timber of commercial value.

The total mileage of the route explored is 690 miles. It is estimated that the length of the line along the route explored from Churchill to Le Pas for the construction of a railway would be 474 miles.

From the above exploration I made of the country, a good railway can be built at reasonable cost, almost anywhere close by my proposed location. What is absolutely necessary is good drainage, the country having so little slope; the closer one follows the rivers, the cheaper the drainage of the line will be.

A railway from Le Pas on the Saskatchewan to Churchill on Hudson Bay would be of the greatest commercial advantage for the people of the west and northwest for the following reasons:—

The average saving in rail transportation for Manitoba, Saskatchewan and Alberta, via Churchill, as against Montreal to Liverpool, would be 970 miles.

The distance from Churchill to Liverpool is 2,946 miles. From Montreal, via Belle Isle, 2,761 miles. From Montreal, via Cape Race, 2,927 miles. From New York, 3,079 miles.

The freight upon grain from the wheat belt to Hudson Bay would approximate 10 cents a bushel, the same as to Port Arthur; the additional 15 cents from there to the Atlantic seaboard would be saved to the farmer, and this of itself represents a fair profit to the wheat grower. Assuming an export trade of 20,000,000 of bushels, which can easily be handled in two months of the season by the proposed railway, the saving of 15 cents a bushel, being the difference in cost of freight from Port Arthur to the Atlantic seaboard, would amount to \$3,000,000.

A very important feature in connection with a railway which secures quick access to the sea is with relation to the shipping of cattle to the European markets; this great industry is at present seriously handicapped in consequence of the long journey to be endured under present conditions. It is admitted as a well recognized fact, that cattle shipped to the Atlantic coast arrive at the shipping port in poor condition, emaciated by long days of rail travel. It is also admitted that on the sea journey

they gain rather than lose in flesh, if put on board in good condition. Experience proves that after three days of rail travel cattle will deteriorate; that three days is about the limit of the time during which they can travel and maintain the condition in which they are placed on board. This being so, cattle could be transported to Fort Churchill without loss in flesh, and the voyage to Liverpool would improve this condition rather than the contrary. Therefore, this great industry alone would find in the Fort Churchill route a solution of the difficulty under which those engaged in the business of cattle shipping now labour.

Mr. F. W. Peters, assistant freight traffic manager of the Canadian Pacific at Winnipeg, states that up to the end of October over 72,000 head of cattle had been shipped to Liverpool from western Canada, and he expected a further 10,000 head to be shipped that season. The freight rate on these cattle would be about 60 cents a hundred pounds in car lots from Winnipeg to Montreal. The rate from Calgary to Fort Churchill would be about the same as to Winnipeg, and the distance about equal, so that this 60 cents a hundred pounds could be saved to the shipper if he could put the cattle on board at Hudson Bay, and he would also prevent the shrinkage which would otherwise occur, by reason of the additional rail journey from Winnipeg to Montreal.

Upon the 82,000 head of cattle shipped to Montreal from the west during the past season, the saving in freight alone, \$6 a head, or in round figures \$650,000, would be equal to about 20 per cent of the selling price.

PULP WOOD.

All the timber between the head of the Little Churchill river and Churchill is reserved for fuel purposes. The pulp wood belt as estimated below, begins at Split lake and extends to Le Pas, ten miles in width on each side of way proposed for route of Hudson Bay railway. On this area, assuming one-sixth to be covered by pulp wood, the balance being river, lakes, ponds, swamps, &c., and assuming 10 cords per acre of an average of 6 inches in diameter, there would be 5,756,660 cords. This is a very low, but safe estimate.

WATER POWERS.

Deer river at its mouth has a minimum flow of 70,000 cubic feet per minute. A dam, 18 feet high, can be built at reasonable cost and would generate 1,600 horsepower. Two dams of same height could be built within ten miles of river mouth, which is 25 miles from Churchill.

North river, which is 350 feet wide during December, had a flow of not less than 250,000 cubic feet per minute. This could be dammed for 15 feet high and would generate about 5,000 horsepower.

On the Churchill river, within 60 and 80 miles from Churchill, large water-power could be developed and transmitted to Churchill.

Nelson river, Burntwood river and Grass river have a number of falls which could be utilized for the development of power for use in pulp mills or other industries.

COAL AND MINERALS.

Notwithstanding a most searching examination was made, I failed to find any coal cropping or indications.

As to minerals, the best specimens of rock which I found at Churchill and surroundings were assayed at the Geological Department, and contained only magnetic iron, no trace of precious metals being found. In the surroundings of Wekusko lake are many exposures of rock of Huronian formation, and this being mineral formation, should precious metals exist, the country would be an easy one in which to prospect.

GAME AND FISH.

From timber line on Hudson Bay to Le Pas are found moose and caribou in fair quantities. Rabbits are scarce throughout the country explored. Saw a few spruce grouse; ptarmigan are found plentifully, but not further south than Grass river.

FISH.

Whitefish abound in all the lakes from Churchill to Le Pas; also in some lakes are found trout, pike and suckers. Indians and travellers rely upon this source of supply for dog feed.

SWAMPS AND MARSH.

About 35 per cent of the country travelled through is marshy and swampy; more or less hay is grown. Under marsh or swamps the soil is generally clay.

FARMING LAND.

I have no doubt that when the swamps and marshes are drained, and moss stripped, they would be susceptible to farming operations between Churchill and Le Pas, but at a later period, after the northwest is settled this land would become valuable.

FROM SEPTEMBER TO JANUARY AT CHURCHILL.

September was very windy, rather cold, and a few days of rain. October, splendid weather, bright and clear. November, some snow and rather windy. December, colder and more snow. The coldest day was 49 degrees below zero on one day. The accompanying schedule shows temperature.

I have the honour to be, sir,

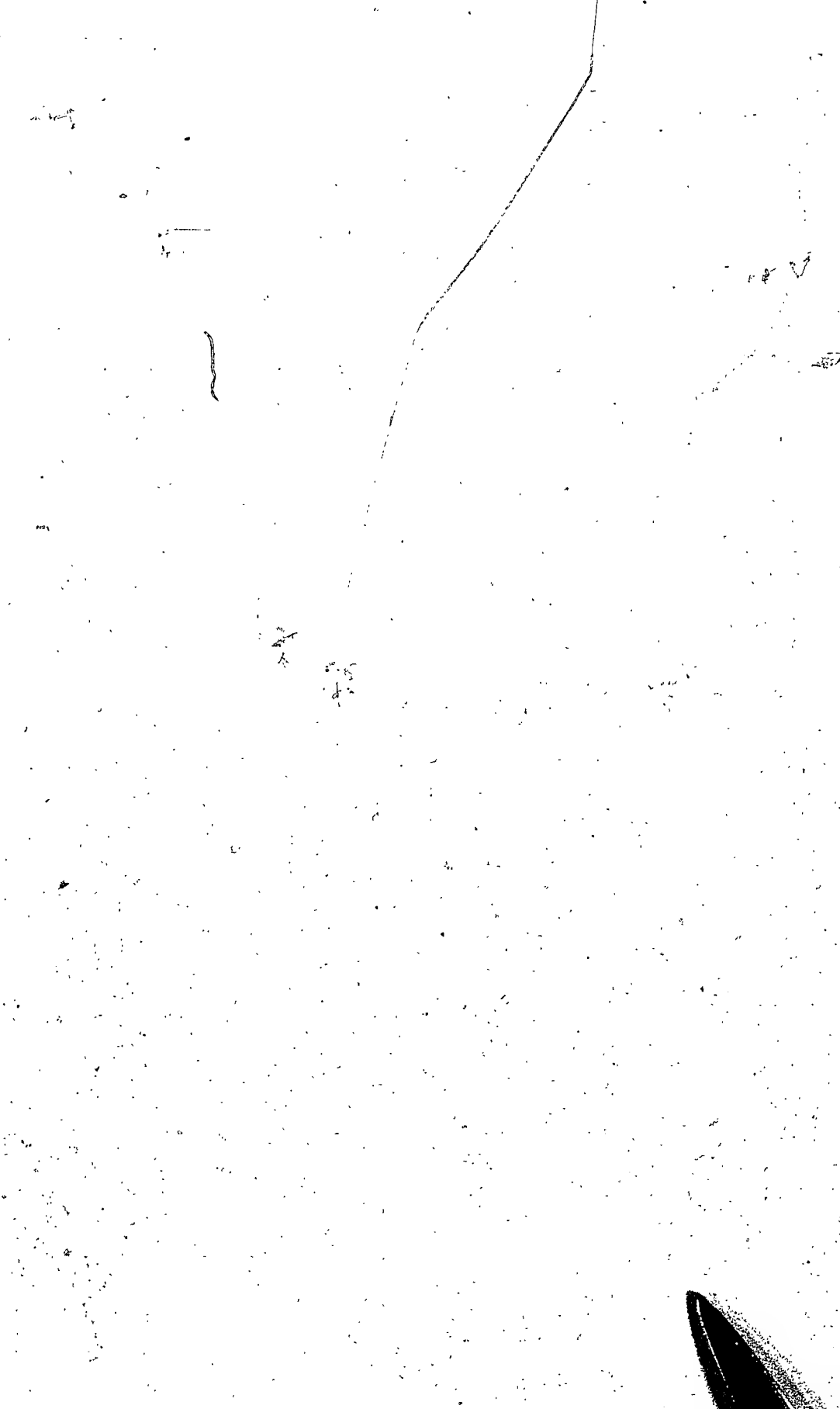
Your obedient servant,

W. THIBAudeau,

Civil Engineer.

Date.	Place.	Aneroid. — 7 p.m.	Temperature. — 7 p.m.	Wind.	Thermometer.		Remarks.
					Minimum.	Maximum.	
1907.							
Jan. 1	Fort Churchill ...						
" 1							
" 2	R.N.W.M.P. Post..	30.67		S	0.00		Bar. at R.N.W.M.P. Post, 10 a.m., B= 30.67; depth of snow, 16 inches.
" 2							
" 3	Mosquito Point.....	29.76					
" 3	"	758 m.m.	5.00	S.E.	5.00		1 m. above Mosquito Pt. tide-water.
" 3	"	29.76					
" 4	"	29.70					
" 4	"	757 m.m.	10.00	N.W.	5.00		
" 4	"	29.75					
" 5	Churchill R	30.09					On the middle of river amongst a bunch of islands opposite mouth of Deer River
" 5	"	763 m.m.	-20.00	Calm.	-0.20		
" 5	"	30.26					
" 6	"	30.14					
" 6	"	765 m.m.	1.00	S.W.	0.00		" some snow.
" 7	On Small Creek.....	30.35					10 ft. above Deer R.
" 7	"	30.33	2.00	W.	0.00		3 m. from its mouth.
" 7	"	768 m.m.					30 ft. above Deer R.
" 8	Deer River.....	30.07					and about 30 miles from its mouth.
" 8	"	762 m.m.	2.00	S.W.	-3.00		About 35 ft. above Deer R. and 55 m. from its mouth.
" 9	"	29.18					
" 9	"	29.19					
" 9	"	742 m.m.	2.00	Calm.	-8.00		Snow 16 to 20 inches deep; head of Deer River.
" 10	Head of Deer R.....	29.06					
" 10	"	737 m.m.	7.00	"	8.00		3 miles below mouth of Little Churchill River, and 124 feet above river.
" 10	"	29.02					
" 11	Churchill R	29.44					
" 11	"	746 m.m.	-1.00	N.W.	-2.00		
" 12	Little Churchill R...	29.72					
" 12	"	754 m.m.	-7.00	S.W.	-10.00		Snow 16 to 18 inches deep.
" 13	"	29.82	-10.00	W.	-14.00		
" 14	"	29.95	-10.00		-18.00		25 miles up Little Churchill River; 10 feet above river.
" 14	Waskaiowaka Lake.	29.72					
" 15	"	29.75	0.00	Calm.	-6.00		At Putnon Indian Camp.
" 15	"	751 m.m.					
" 16	Towards Split Lake.	29.64					
" 16	"	29.67	-10.00	S.W.	-10.00		Banks 16 feet deep.
" 16	"	750 m.m.					Snow 29 inches deep.
" 17	15 miles from	29.36					
" 17	Split Lake.....	29.36	-2.00	S.W.	-5.00		
" 17	"	744 m.m.					
" 18	Split Lake.....	29.46					At Indian Fishing Camp.
" 18	"	747 m.m.	-25.00	S.W.	-10.00		Snow 24 to 26 inches deep; 14 feet above Lake.
" 19	"	29.60					
" 19	"	751 m.m.	-28.00	S.	-39.00		
" 19	"	29.66					
" 20	"		-32.00	Calm.	-48.00		
" 21	Churchill R...	29.98					First rapid, 30 feet above first rapid.
" 21	"	749 m.m.	-28.00	S.	-42.00		8 feet above Grass R. and 15 miles from its mouth.
" 22	Grass River	29.96					About 35 feet above river.
" 22	"	761 m.m.	-28.00	S.W.	-38.00		
" 22	"	30.12					
" 23	Natawanan	29.55					
" 23	Grass River	749 m.m.	-28.00	S.	-42.00		
" 24	"	29.75					
" 24	"	753 m.m.	-4.00	Calm.	-9.00		" "
" 24	"	29.85					
" 25	"	29.47					

Date.	Place.	Aneroid. — 7 p.m.	Tempé- rature. — 7 p.m.	Wind.	Thermometer.		Remarks.
					Minimum.	Maximum.	
1907							
Jan. 25	Grass River.....	748 m.m.	-14.00	S.	-28.00		
" 25	"	29.55					Camp on a portage
" 26	"	29.51					about 20 feet above
" 26	"	747 m.m.	-14.00	S.	-18.00		river.
" 26	"	29.52					Snow 3 feet deep.
" 27	Nelson River.....	29.65	-35.00	S.W.	-38.00		Head of Nelson and
" 27	"	747 m.m.					Sipiwek Lakes ;
" 27	"	29.72					8 feet above.
" 28	"	29.69					On an island, snow
" 28	"	748 m.m.	-34.00	S.W.	-42.00		3½ feet deep, 7 feet
" 28	"	29.80					above Sipiwek
" 29	Sipiwek Lake.....	29.72					Lake.
" 29	"	29.75	-34.00	S.W.	-38.00		Portage between Sipi-
" 29	"	752 m.m.					wek Lake and
" 30	Cross Lake.....	29.55					Grass Lake.
" 30	"	756 m.m.	-34.00	S.W.	-38.00		H. B. Co. Post, 14
" 30	"	29.56					feet above Lake.
" 31	"	29.46					
" 31	"	747 m.m.	-28.00	S.W.	-40.00		" "
" 31	"	29.43					
Feb. 1	"	29.68					H. B. Co. Post,
" 1	"	754 m.m.	-20.00	S.W.	-24.00		McLeod's Place.
" 1	"	29.80					14 feet above lake.
" 2	"	29.75					" "
" 2	"	755 m.m.	-30.00	S.W.	-42.00		
" 2	"	29.86					
" 3	"	29.47					" "
" 3	"	749 m.m.	-18.00	Calm.	-38.00		
" 3	"	29.54					
" 4	West of Cross Lake.	29.46					
" 4	"	747 m.m.	-12.00	S.W.	-7.00		3 feet deep of snow
" 4	"	29.54					35 feet above river.
" 5	Duck Lake.....	29.66					
" 5	"	751 m.m.	-16.00	W.N.W.	-20.00		7 miles west of lake.
" 5	"	29.67					
" 6	Grass River.....	29.56					
" 6	"	751 m.m.	-16.00	W.	-49.00		5 feet above.
" 6	"	29.59					
" 7	One mile from	29.33					
" 7	mouth of Grass	742 m.m.	-12.00	Calm.	-16.00		Snow 2½ feet deep.
" 7	River.....	29.34					" "
" 8	North of Wekusko	29.20					" "
" 8	Lake.....	736 m.m.	0.00	W.	-10.00		Snow, 3 feet deep, 30
" 8	"	29.20					feet above.
" 9	"	29.24					
" 9	"	742 m.m.	0.00	Calm.	-15.00		" "
" 9	"	29.29					" "
" 10	End of Railway Line	29.42					
" 10	"	745 m.m.	-28.00	S.W.	-30.00		Grass River, 15 feet
" 10	"	29.45					above.
" 11	Reed Lake.....	29.10					
" 11	"	736 m.m.	-5.00	S.W.	-10.00		6 feet above.
" 11	"	29.12					
" 12	Railway Line.....	28.73					
" 12	"	729 m.m.	34.00	S.W.	28.00		16 miles from Cor-
" 12	"	28.73					morant Lake.
" 13	"	29.27					
" 13	"	740 m.m.	5.00	S.W.	3.00		On a small creek.
" 13	"	29.26					
" 14	Cormorant Lake.....	28.87					
" 14	"	731 m.m.	5.00	Calm.	-5.00		At the Narrows, 8 feet
" 14	"	28.85	5.00	"			above lake.
" 15	Clear Water Lake	29.12					" "
" 15	"	737 m.m.	30.00	"	20.00		South end, 6 feet
" 15	"	29.12					above.
" 16	Le Pas.....	28.86					" "
" 16	"	733 m.m.	2.00	"	5.00		" "
" 16	"	28.87					At McLeod's.



R.N.W.M.P. POST

Erected 1906

Scale
100 0 100

RESIDENCE OF COMMANDANT

STORE

WAREHOUSE GUARD ROOM

SHED

BARRACKS



HON. FRANK OLIVER

Minister of the Interior

MAP OF CHURCHILL HARBOUR

BY W. THIBAudeau, C. E.

1907

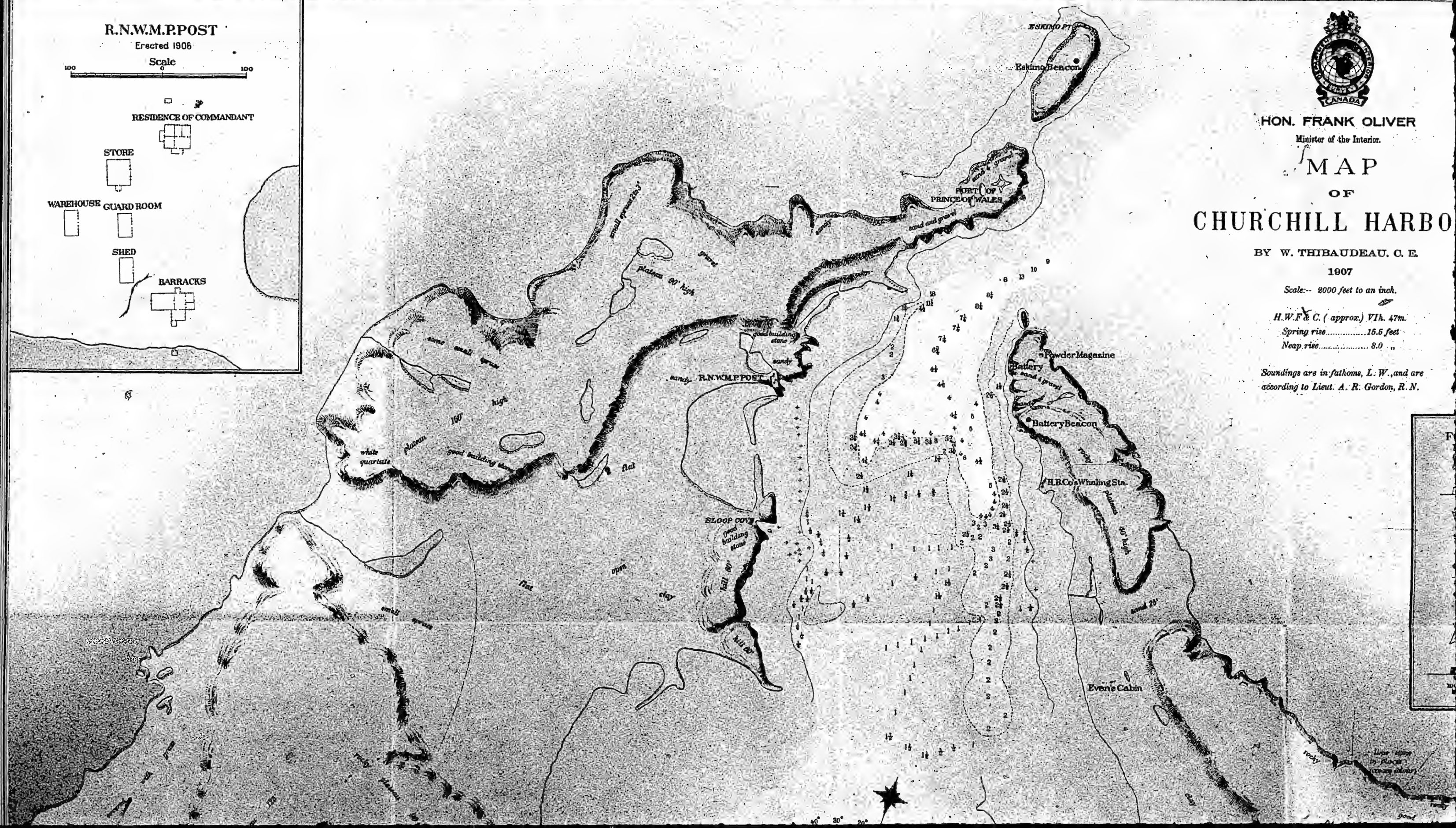
Scale:-- 2000 feet to an inch.

H.W.F. & C. (approx.) Vth. 47m.

Spring rise.....15.6 feet

Neap rise.....8.0 "

Soundings are in fathoms, L. W., and are according to Lieut. A. R. Gordon, R. N.



W.M.P. POST

Erected 1906

Scale 0 100

RESIDENCE OF COMMANDANT

ROOM

BARRACKS



HON. FRANK OLIVER

Minister of the Interior.

MAP

OF

CHURCHILL HARBOUR

BY W. THIBAudeau, C. E.

1907

Scale:-- 2000 feet to an inch.

H.W.F. & C. (approx.) Vth. 17th.

Spring rise.....16.5 feet

Neap rise.....8.0 "

Soundings are in fathoms, L. W., and are according to Lieut. A. R. Gordon, R. N.

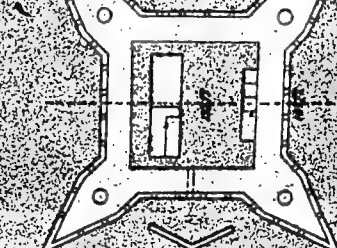
FORT PRINCE OF WALES

Erected 1733-47 (Joseph Robson Eng)
Captured and partly destroyed by the
French Admiral La Perouse 8th Aug. 1782

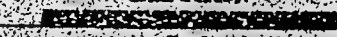
SECTION



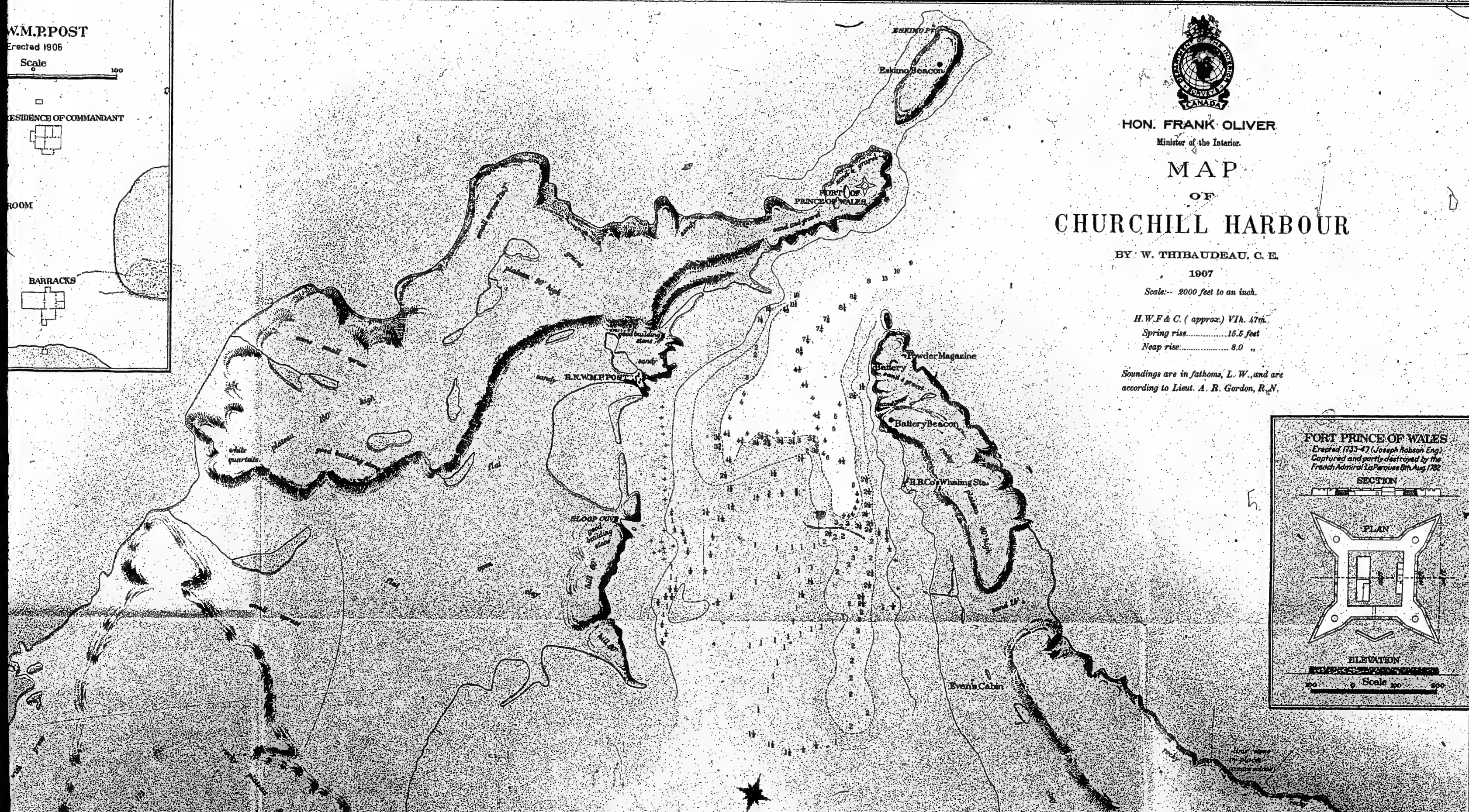
PLAN



ELEVATION

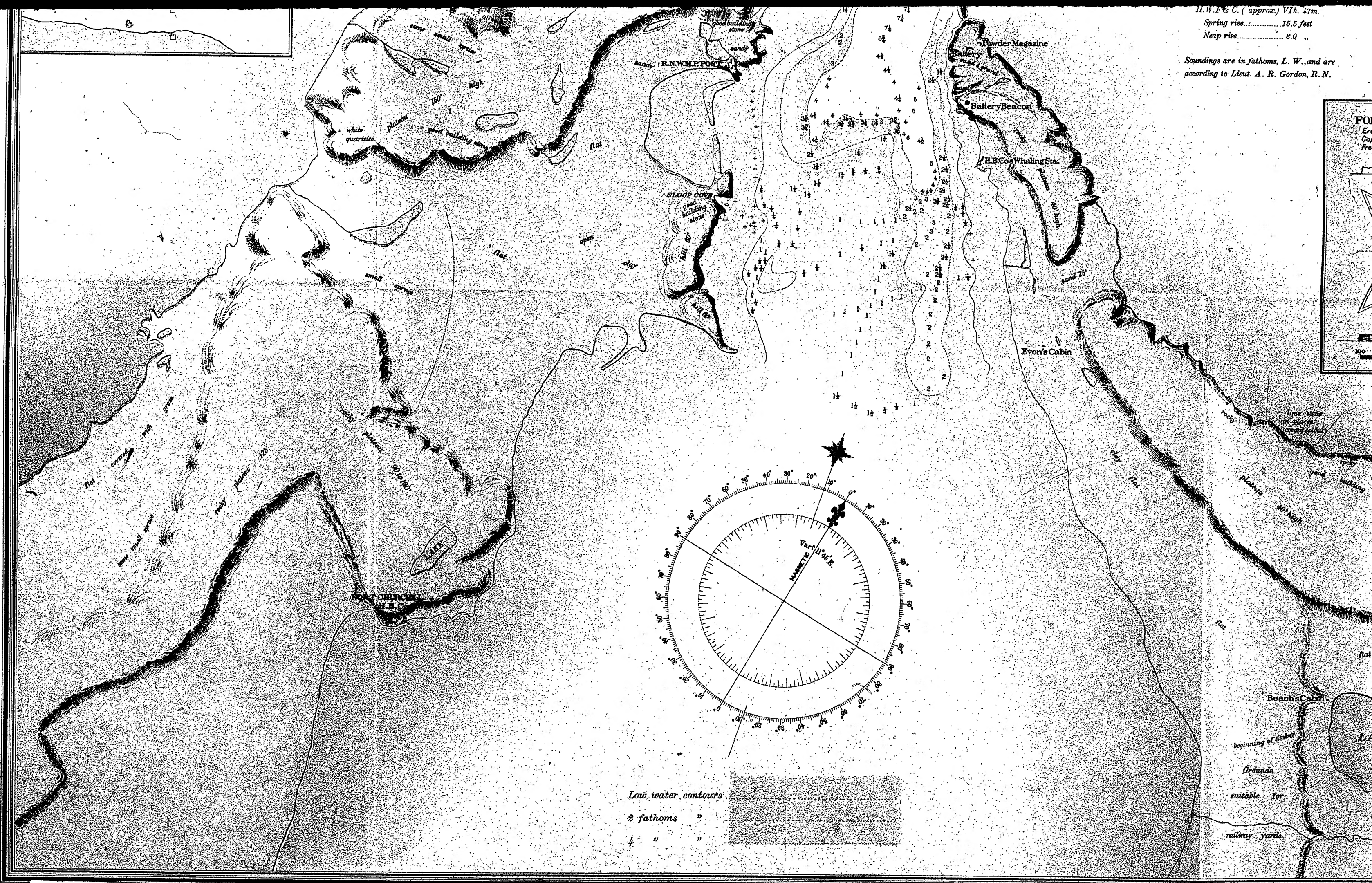


Scale 100 200



H.W.F. & C. (approx.) Vth. 47m.
 Spring rise.....15.5 feet
 Neap rise.....8.0 "

Soundings are in fathoms, L. W., and are according to Lieut. A. R. Gordon, R. N.




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H.W.F & C. (approx.) Vth. 47m.
 Spring rise.....15.5 feet
 Neap rise..... 8.0 "

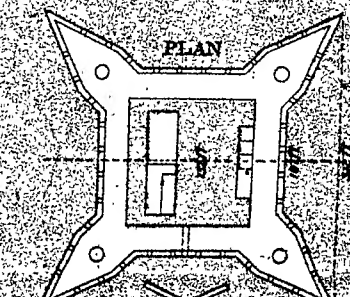
Soundings are in fathoms, L. W., and are according to Lieut. A. R. Gordon, R.N.

FORT PRINCE OF WALES
 Erected 1753-47 (Joseph Robson Eng)
 Captured and partly destroyed by the French Admiral La Perouse 8th Aug. 1782


SECTION



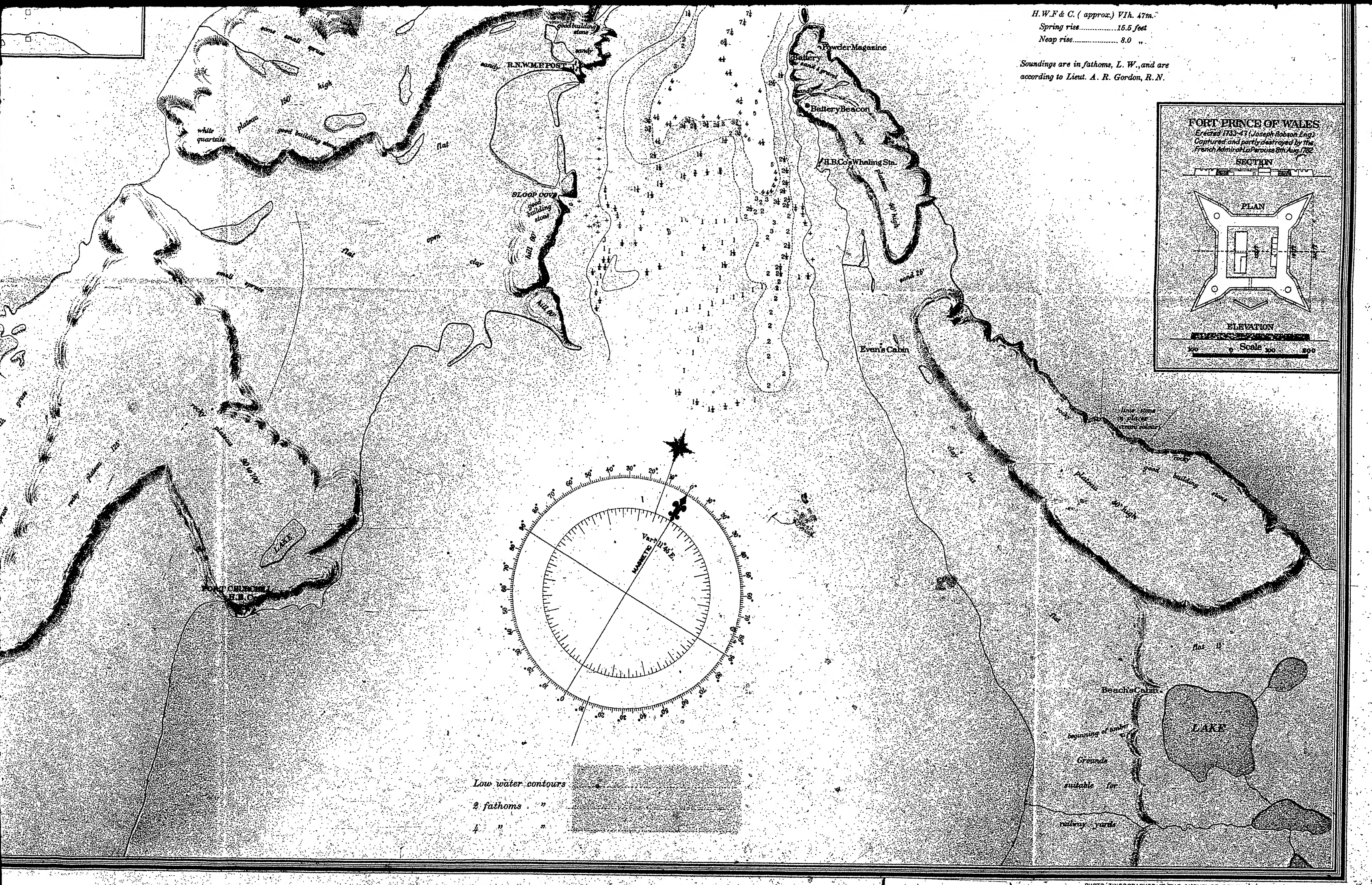
PLAN

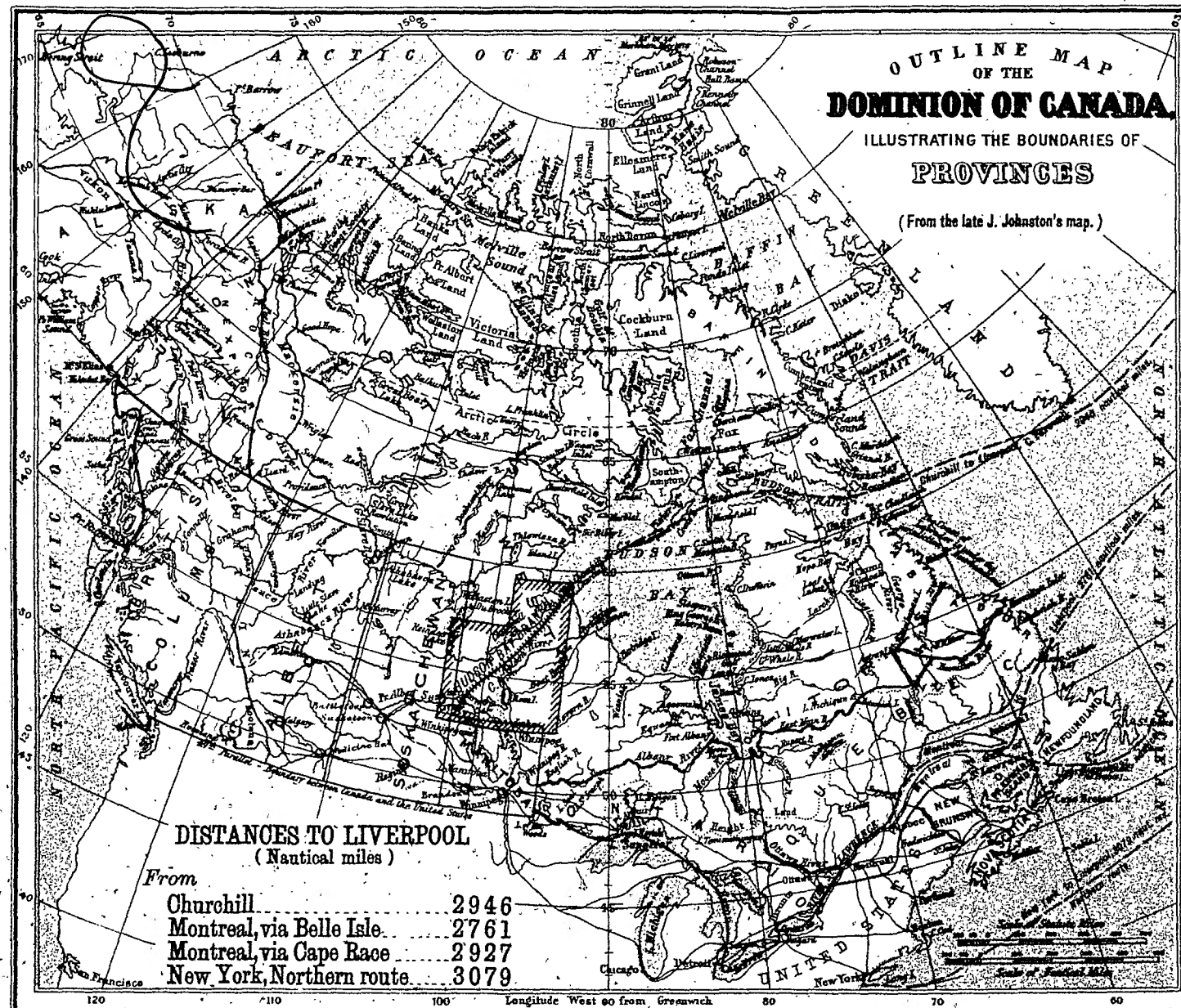


ELEVATION



Scale 100 200 300





RAIL DISTANCES (Statute miles)			
From	To Montreal	To Churchill	Difference
Winnipeg	1422	945	477
Brandon	1555	940	615
Regina	1780	774	1006
Medicine Hat	2082	1076	1006
Calgary	2262	1256	1006
Prince Albert	1958	717	1241
Battleford	1994	876	1118
Saskatoon	1924	806	1118
Edmonton	2247	1129	1118
Average saving in rail transportation for Manitoba, Saskatchewan and Alberta ---			967

Note:- The distances from Regina, Medicine Hat and Calgary to Churchill are computed on the assumption of direct railway connection between Regina and Etoimami.

